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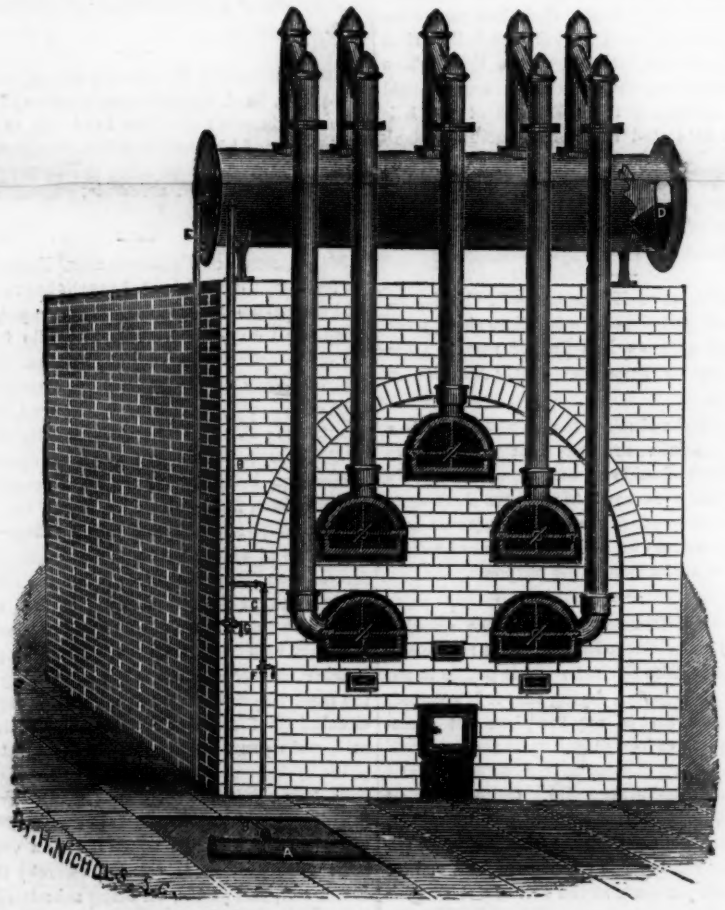
IN ADVANCE.

The "Vacuum Process" of George A. McIlhenny.

To the fine cuts, in illustration of this invention, placed before our readers to-day, it is judged preferable to append Mr. McIlhenny's own description, as transmitted by him. The editor takes this opportunity, however, to state, that he has had good opportunity, of late, in the course of visits he has made to the works in both Washington and Portland, to observe personally the workings of Mr. McIlhenny's methods; and in other columns will be found the conclusions drawn from these observations.]



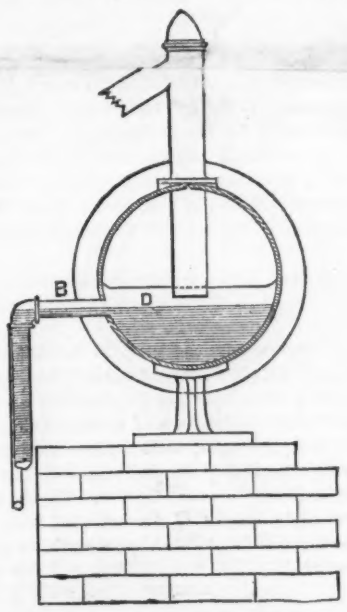
The means that I have adopted to produce the "Vacuum Process," (supposing the exhauster to be worked at zero) is shown in the annexed cuts. The hydraulic main is divided into compartments by a bridge marked D, at the height of the overflow pipe, E, and three-quarters of an inch above the mouths of the dip-pipes (the hydraulic main over each bench forming a compartment). A is a tar pipe four or six inches diameter, laid in front of the benches, and under the floor, connecting in the usual manner with the tar well.

B is a 1½ inch tar pipe connecting with the main tar pipe A, and the hydraulic main, three-quarters of an inch *below* the mouths of the dip pipes. So that when the cock, G, is open, the tar is removed to a point that will leave the mouths of the dip pipes exposed, or unsealed.

C represents a half-inch water pipe, connected with the pipe B, any where above the cock G, for the purpose of resealing the bench when it i being drawn and recharged.

When a bench is to be *drawn*, the cock G is to be closed, and the cock F opened for a few seconds, in order to seal the dip pipes: as soon as the bench is charged, the cock G is again opened, and the bench is unsealed.

Now this means is so simple and effective, that it requires no more than the ordinary skill of a stoker to work the benches, as it only involves the turning of two cocks at each charge. And should any benches get out of repair, all that is necessary is to leave on the seal. You will perceive that one, or all the benches can be worked with or without the seal, at pleasure. There is nothing to get of order; and fifteen dollars to a bench will attach it to any works, old or new. nor does it in any way alter, change, or interfere with the arrangement of the works, as before constructed.



To sum up in a few words the benefit of this process:

1st. Greatly decreasing the deposit of carbon in the retorts.

2nd. Increasing the heats, and ensuring more uniformity.

3rd. Giving the retorts full capacity.

4th. *Very much* increasing the yield from the coal.

5th. Reducing the number of retorts required. And all the incidental results that will follow.

In order to fully understand the process, and learn the results, you are invited to visit these works, or the gas works at Portland, Maine, and make such inspection and experiments as will satisfy you of its merits.

Yours very truly,

GEORGE A. McILHENNY,
Engineer, Washington Gas-Light Company,
Washington, D. C.

Chemical Repertory.

No. 81.—December 2, 1872.

EDITOR—HENRY WURTZ.

CHEMICAL EXCERPTS.

551. Gas Wells on the Pacific Coast.—The *Scientific Press* informs us that at Salinas City, lately, while boring an artesian well, the workmen struck a gas jet a depth of 70 feet, which increasing in violen carried out earth and stones loosened by the machinery. The gas has been tested and burns with a clear brilliant flame. The gravel which is thrown up through the pipe has the appearance of decomposed gravel, and the water has a slight taste of sulphur. Salinas City may yet be lighted with natural gas.

In a subsequent issue, appears the following further item:

The gas well discovered at Salinas City some few weeks since, having been closed up for a few days, opened on the 18th inst., and continues to throw gas, stones and water with the same force it did at first. It was again ignited and proved to contain all its previous good qualities. This gas will probably be utilized in lighting the town.

552. Gas-Proofing India-Rubber.—Though there is nothing particularly novel (to chemists, at least) in the following, from an English exchange, some readers may nevertheless like to have the item:

"Ordinary vulcanised india-rubber tubing becomes saturated with gas, which again evaporates at its outer surface, causing a most disagreeable smell. An invention for the prevention of this, by coating the india-rubber with varnish, has been patented. The chief novelty in it is that the varnish is easily made, and it renders the substance of the tube impervious to gases. This varnish is composed of linseed oil, fine litharge, or white lead, in the proportion of one quart of oil to one pound of litharge. These substances should be well boiled together until brought to a proper thickness or body, and while hot the composition is applied by running it through the tube to be coated or lined. The varnish for the outside is made by mixing one quart of linseed oil with half-a-pound of litharge, and by adding to the same about a gill of gold size—these ingredients should be well boiled together, and while hot should be applied with a brush or a sponge.

553. Artificial Mirage.—Prof. C. Maxwell exhibited to the British Association an arrangement for showing this.

The apparatus used for the purpose consisted of a cubical vessel, with plate-gluss sides, six inches square, and containing three liquids of different specific gravities. The lowest solution was of saturated alum-water, the highest pure water, while the intermediate one contained Scotch whiskey mingled with sufficient sugar to bring its gravity between the two. Through this instrument triple images of an extended landscape could be obtained without difficulty, the middle image being inverted.

554. President Morton on Fluorescence.—Our readers will remember this gentleman's original communication to us on new discoveries of his in the fluorescence of certain hydrocarbons found associated with anthracene. He has recently been exhibiting these phenomena in public lectures. In Philadelphia, Nov. 6, he showed the following:

A large screen, of a pale yellow color, was lowered from the upper regions of the stage, and, as the lecturer expressed it, was interrogated in the way of experiment as to what property it possessed, by various colors of light. A brilliant yellow, a green and a red light were successively thrown upon it from an electric lamp, but it remained unchanged and made no sign, then a violet light from the same source streaming over it the word "Fluorescence," flashing out upon the cloth in immense letters of luminous green, at once answered the question and illustrated the property. So again a gigantic flower, painted in pale monochrome, gleamed out in varied and vivid tints, under a like treatment. In another place the speaker alluded to the invisible rays present in the solar beam and some other light, which though inappreciable to the human eye, are very active in photography, and then did, what has certainly never been before been accomplished—that is, showed the rays, on a fluorescent screen, to the immense audience assembled to hear him. The invisible spectra of copper, silver, zinc, &c., were thus projected and compared.

555. A New and Extraordinary form of Photometer.—F S. Provenzali, makes the following suggestions, as stated in *Les Mondes*:

Thermometers made of a solution of iodine in bisulphide of carbon exposed to the light are from 0·20 to 0·25 more sensitive than those made of bisulphide of carbon alone; in the dark, however, their expansion is almost equal. A thermometer made of solution of iodine in bisulphide of carbon will rise or fall in passing from light to darkness or the reverse, while a mercury thermometer will remain sensibly stationary. The saturated solution of iodine in bisulphide of carbon has very little power of reflection, is perfectly opaque and is not changed chemically by light; hence the rays of light reflected by mercury are absorbed by the solution of iodine, or transformed into heat, which expands the solution itself. He employs these facts in devising a photometer of constant action. Two thermometers are placed together, one of mercury divided into fiftieths of a degree, the other of iodine in bisulphide of carbon whose scale in the dark is the same as the mercury thermometer. These thermometers are affected equally in the dark, but under the action of light the one with the iodine solution rises higher according to the intensity of the light. Two mercury thermometers, both of which are shielded from the light excepting the bulbs, one of which is plunged into a saturated solution of iodine in bisulphide of carbon, in the dark will both exhibit the same degree of expansion, but exposed to light, the one immersed in the iodine solution will expand much more rapidly and show a permanent difference depending upon the intensity of the light.

556. Manufacture of Hydrogen.—Of the following plan we have had already, some time since, some intimations, and wish we had further results. The present item comes from the *Revue Hebdom. de Chimie:*

M. Giffard by first reducing to the metallic state a peculiar kind of iron ore found at Chateauroux (France) by means of oxide of carbon, obtains finely divided iron, which is used to prepare hydrogen, which thus costs only ½d. per cubic metre (35·31 English cubic feet) and may be used for various heating, illuminating, and air-balloon filling purposes.

557. Economizing Domestic Fuel.—The growing importance of this in Great Britain, gives rise to singular suggestions. The *Spectator* wants people to put *solid bottoms* to their grates, saying that it is asserted, and indeed proved, that in any fire-place not excessively small, a plate of iron placed upon the grate will halve the consumption of coal, reduce the smoke, and leave a cheerful, free-burning fire. Quite sufficient air enters through the bars, no poking is necessary, and the fire never goes out till the coal is consumed. Any householder can try this experiment, and reduce his coal bill say 30 per cent. at the cost of a shilling.

558. Anhydrous Nitric Acid.—R. Weber has made some remarkable observations on this compound.

He first refers to the researches of Deville, Odet, and Vignon on the anhydrous nitric acid prepared by the action of chlorine upon dry nitrate of silver, and also to the earlier experiments of Thenard, Gay-Lussac and others for dehydrating strong nitric acid by means of sulphuric acid. The author next describes at lengt a series of experiments which show that, after having prepared a concentrated nitric acid by re-distilling several times a mixture of strong nitric and concentrated sulphuric acids by the action of pure phosphoric anhydride (care being taken to keep the nitric acid cold by means of ice applied to the vessel wherein it is contained) nitric acid may be obtained in the solid anhydrous crystalline state. This substance has a sp. gr. of 1·64; it is rather prone to spontaneous decomposition, especially at a somewhat high temperature—above 10°—sulphur, phosphorus, and the readily oxidisable metals (potassium and sodium) act upon this anhydride energetically, but carbon, aluminum, zinc, cadmium, iron, nickel, titanium, copper, lead, tin, bismuth, antimony, tellurium and thallium are quite passive with this substance; pure clean silver and palladium are not acted upon by it, but metallic arsenic and mercury are oxidised. Upon many of the organic substances this nitric anhydride acts strongly.

559. Pocket Spectroscope.—M. Hofmann has perfected a very convenient form of spectroscope that can be carried in the waistcoat pocket, and is yet capable of really wonderful effects, considering its diminutive size, producing a large and brilliant spectrum, the violet rays of which extend far beyond the line G. It has a lens of rock crystal, with perfectly flat parallel faces at each end to keep out all particles of dust, etc. The organ of dispersion and analysis is a compound prismoid formed of three alternating prisms, one, of the most powerfully dispersive flint glass that can be procured, between two reversed prisms of crown, the angles being specially and skilfully arranged. The combination is completed by an ordinary compound doublet lens of suitable focal length.—*Scientific American.*

560. Spheroidal State.—In one of his recent lectures here, Prof. Pepper repeated some of the remarkable experiments under this head. It is stated that, having dipped his hand in ether, he withdrew an egg from boiling water, and then, having fully washed his hand in concentrated ammonia, stirred molten lead with his finger.

561. Pasteur on Fermentation.—From *Les Mondes* we learn that the celebrated *savant* has recently found that saccharine liquids (must from grapes, malt infusions, etc.) do not enter into alcoholic fermentation solely by contact with oxygen, but that the introduction of germs or dust—*poussiere*—present upon the fruit of the vine is absolutely required to cause fermentation; this fact is experimentally demonstrated by the description of the mode of operating. The author also briefly alludes to some recent researches made by him, from which he draws the conclusion that two different orders of living beings exist in Nature—one of which, visible to the naked eye, requires free oxygen for sustenance; while the other, microscopically small objects, is killed by free oxygen, but lives upon that drawn from any of its combinations, carbonic acid for instance. Fruit—apples, pears, peaches, etc.—continues to live after being pulled from the trees which produced it, and, while exposed to free circulation of air, absorbs oxygen, exhales carbonic acid, and ripens. When fruit is exposed to an atmosphere of carbonic acid, this kind of life ceases, and the fruit, being prevented from absorbing oxygen, begins to assimilate oxygen from its own juice (saccharine material), the result of which is that a veritable alcoholic fermentation is set up, whereby the fruit becomes soft, and yields, on being submitted to distillation, pure alcohol, while carbonic acid is given off. This communication is as yet a preliminary one, since the researches are not yet complete.

562. The British Fuel Question.—The discovery of coal at Sandwell-park, near Birmingham, bids fair to settle the long disputed point as to the existence of the coal measures at a workable depth underneath the Permian, or New Red Sandstone formation. The importance of the question, should it be finally decided, will be apparant if we refer to some statistics

recently quoted on the subject by Professor Ramsay. The South Staffordshire coal field, he tells us, is supposed to contain 3,201,672,216 tons, but beneath the Permian beds adjoining are not less than 10,380,000,000 tons. The Warwickshire fields contains 458,652,714 tons, but the concealed area is 2,494,000,000 tons. The Leicestershire field contains 836,799,734 tons; a further store of 1,790,000,000 tons lies beneath the Permian rocks supposed to mark the boundary of the coal measures. The practical question is whether the coal measures which underlie these Permian rocks are deposited at a workable depth. In two places this fact has already been satisfactorily proved, viz., at the Shire Oaks, Nottinghamshire, on the estate of the Duke of Newcastle, and at Lilleshall, in Shropshire, on the estate of the Earl of Granville. The fact that at Sandwell the first measure of coal has been reached at a depth less by 100 yards than had been anticipated, is highly encouraging, and gives good ground for hope that the Midland coal fields, so far from being in danger of exhaustion, are almost illimitable in their resources.

The shares of the Sandwell-Park company, on which £60 have been paid, are quoted £600 to £750 each. No transactions are, however, reported since the discovery of coal.—*English Exchange.*

563. Pacific Coast Fuels.—The coals of this coast, the *Scientific Press* tells us, including the Rocky Mountains, Mount Diablo and Oregon, at present worked, belong to a much later age than the coals of Pennsylvania and Virginia, and those we import from England. Our coals are not suited to iron making in the furnace and the rolling mill. Iron ore of excellent quality abounds in California; but for want of suitable coals, and by reason of distance inland, it is unavailable. True coal of the ancient Carboniferous formation, is reported in the Trinity River country. It is a true caking, bituminous coal. Recent exploration describes this coal-basin as thirty miles long, and it seems of good size. It is underlaid with rich ironstone. Here, probably, will be the great iron factories of the State.

564. Cure for a Cold.—A method for curing coryza (coal in the head) with rapidity, consists in inhaling the tincture of iodine, a phial of which is to be held in the hand, and placed under the nose. The warmth of the hand causes the vaporization of the tincture. The inhalations are to be made every three minutes, and soon all symptoms of the malady will disappear.—*Scientific Press.*

565. Carbon and Oxygen Consumption.—Dr. Van der Weyde gives us some curious calculations, which might be followed up further with advantage. It is estimated that, for the United States alone, the value of all coal, wood, oil, petroleum, gas, etc., burned up, has now nearly reached the amount of 100 million dollars per year. If we estimate that for 6.66 dollars we may obtain fuel containing one ton of carbon, or for 10 dollars, 3000 lbs., the 100 million dollars will buy 30,000 million lbs. of carbon in the fuel; this combining with 80,000 million lbs. of oxygen, forming 110,000 million pounds of carbonic acid, throws this in the atmosphere. As a cubic yard of oxygen weighs 2 lbs., 40,000 million cubic yards of oxygan are withdrawn and substituted by nearly the same bulk of carbonic acid.—*Manufacturer and Builder.*

566. Iron Deposited by Electricity.—The following conclusions have been reached in the course of investigations into the characteristics of iron deposited by electricity: First, iron and copper when deposited absorb a certain amount of gas, especially hydrogen; second, the volume of the gas absorbed by iron varies between widely extended limits—this, in the case of iron, being sometimes as much as 185 times its volume; third, absorption of gas takes place principally in the layers which are deposited first; fourth, when such iron is heated the disengagement of the gas commences below the temperature of 212°. At this temperature it is principally hydrogen that is separated.—*Scientific Press.*

567. Action of Cold on Iron.—This action, concerning which much diversity of opinion exists, is illustrated pretty forcibly by the experience of the Grand Trunk Railway of Canada, which is exposed to severe cold, and a great deal of it. At the recent half-yearly meeting of the company, in London, the President said that 3,500 to 4,000 rails on the line break every winter; but he found comfort in the fact that, in about 410 miles of steel track, only eight or ten rails have brokon. It was feared when Bessemer rails were first introduced, that their resistance to wear would be counterbalanced by unusual liability to break, and that they would be especially dangerous in severe climates, the impression being apparently that, having something of the hardness of cast-iron, they had also something of its brittleness. This experience of the Grand Trunk, however, indicates that they are especially fitted for such climates.—*English Exchange.*

Coal as a Reservoir of Power.

By Robert Hunt, F. R. S.

The sun, according to the philosophy of the day, is the great store-house of force. All the grand natural phenomena are directly dependent upon the influence of energies which are poured forth without intermission from the central star of our system. Under the influences of light heat, actinism, and electricity, plants and animals are produced, live and grow, in all their infinite variety. Those physical powers, or, as they were formerly called, those imponderable elements, have their origin in one or other of those mysterious zones which envelop the orb of day, and become evident to us only when mighty cyclones break them up in dark spots. Is it possible to account for the enormous amount of energy which is constantly being developed in the sun? This question may be answered by saying that chemical changes of the most intense activity are discovered to be forever progressing, and that to these changes we owe the development of all the physical powers with which we are acquainted. In our laboratory we establish, by mechanical disturbance, some chemical phenomenon, which becomes evident to our senses by the heat and light which are developed, and we find associated with them the principle which can set up chemical change and promote electrical manifestations. We have produced combustion, say, of a metal, or of a metallic compound, and we have a flame of a color which belongs especially to the substance which is being consumed. We examine a ray of the light produced by that flame by passing it through a prism, and this analysis informs us that colored bands, having a fixed angle of refraction, are constant for that especial metal, Bevond this, research acquaints us with the fact that, if the ray of light is made to pass through the vapor of the substance which gives color to the flame, the lines of the spectrum which were chromatic become dark and colorless. We trap a ray of sunlight and we refract it by means of a spectroscope—an instrument giving results which are already described in this journal (*Popular Science Review*, vol. 1., pp. 210–214)—when we detect the same lines as those which we have discovered in our artificial flame. We pursue this very interesting discovery, and we find that several metals which give color to flame, and produce certain lines, when subjected to spectrum analysis, are to be detected in the rays of the sun. Therefore our inference is, that some substances, similar to the terrestrial bodies, with which we are familiar, are actually undergoing a change in the sun, analogous to those changes which we call combustion; and, more than this, we argue that the high probability is, that all solar energies are developed under those conditions of chemical change—that, in fact, the sun is burning, and while solar matter is changing its form, Force is rendered active, and as ray-power passes off into space as light, heat, etc., to do its work upon distant worlds, and these forms of Force are expended in doing the work of development on those worlds. This idea—theory—hypothesis—call it what you may—involves of necessity the waste of energy in the sun, and we must concede the possibility of the blazing sun's gigantic mass becoming eventually a globe of dead ashes, unless we can comprehend some method by which energy can be again restored to the inert matter. Certain it is that the sun has been shining thousands of years, and its influence on this earth we know to have been the production of organized masses, absorbing the radiant energies in volumes capable of measurement. On this earth, for every equivalent of heat developed, a fixed equivalent of matter has changed its form; and so likewise is it with regard to the other forces. On the sun, in like manner, every cubic mile of sunshine represents the change of form of an equivalent of solar matter, and that equivalent of matter is no longer capable of supplying Force, unless by some conditions, beyond our grasp at present, it takes up again that which it has lost. That something of this kind must take place is certain. The sun is *not burning out.* After the lapse of thousands of years we have the most incontrovertible evidence that the light of to-day is no less brilliant now than it was when man walked amid the groves of Eden. We may venture farther back into the arcana of time, and say that the sun of the past summer has shone with splendor equal to the radiant power which, myriads of ages ere man appeared on this planet, stimulated the growth of those luxuriant forests that perished to form the vast beds from which we derive our coal. Not a ray the less is poured out in any hour of sunshine; not a grain-weight of matter is lost from the mass of the sun. If either the sunshine were weakened, or the weight of the vast globe diminished, the planets would vary in their physical conditions, and their orbits would be changed. There is no evidence that either the one or the other has happened. Let us see if we can guess at any process by which this stability of the solar system is maintained.

It was first shown by Faraday, in a series of experimental investigations which may be regarded as the most beautiful example of inductive science with which the world has been favored since Bacon promulgated his new philosophy, that the quantity of electricity contained in a body is exactly the quantity which is necessary to decompose that body. For example, in a voltaic battery—of zinc and copper plates—a certain fixed quantity of electricity is eliminated by the oxidation of a portion of the zinc. If, to produce this effect, the oxygen of a given measure of water—say a drop—is necessary, the electricity developed will be exactly that which is required to separate the gaseous elements of a drop of water from each other. An equivalent of electricity is developed by the oxidation of an equivalent of zinc, and that electricity is required for the decomposition of an equivalent of water, or the same quantity of electricity would be equal to the power of effecting the recombination of oxygen and hydrogen, into an equivalent of water. The law which has been so perfectly established for electricity is found to be true of the other physical forces. By the combustion—which is a condition of oxidation—of an equivalent of carbon, or of any body susceptible of this change of state, exact volumes of light and heat are liberated. It is theoretically certain that these equivalents of light and heat are exactly the quantities necessary for the formation of the substance from which those energies have been derived. That which takes place in terrestrial phenomena is, it is highly probable, constantly taking place in solar phenomena. Chemical changes, or disturbances analogous to them, of vast energy, are constantly progressing in the sun, and thus is maintained that unceasing outpour of sunshine which gladdens the earth, and illumines all the planets of our system. Every solar ray is a bundle of powerful forces; light, the luminous life-maintaining energy, giving color to all things; heat, the calorific power which determines the conditions of all terrestrial mat-

ter; actinism, peculiarly the force which produces all photographic phenomena; and electricity, regulating the magnetic conditions of this globe. Combined in action, these solar radiations carry out the conditions necessary to animal and vegetable organization, in all their varieties, and *create* out of a chaotic mass forms of beauty rejoicing in life.

To confine our attention to the one subject before us. Every person knows that, to grow a tree or a shrub healthfully, it must have plenty of sunshine. In the dark we may force a plant to grow, but it forms no woody matter, it acquires no color; even in shade it grows slowly and weak. In sunshine it glows with color, and its frame is strengthened by the deposition of woody matter eliminated from the carbonic acid of the air in which it grows. A momentary digression will make one point here more clear. Men and animals live by consuming the products of the vegetable world. The process of supporting life by food is essentially one of combustion. The food is burnt in the system, developing that heat which is necessary for life, and the living animal rejects, with every expiration, the combinations, principally carbonic acid, which result from this combustion. This carbonic acid is inhaled by the plant; and, by its vital power, excited by sunshine, it is decomposed; the carbon forms the ligneous structure of the plant, and the oxygen is liberated to renew the healthful condition of the atmosphere. Here we see a sequence of changes analogous to those which have been shown to be a law of electricity.

Every equivalent of matter changing form in the sun sends forth a measured volume of sunshine, charged with the organizing powers of potential energies These meet with the terrestrial matter which has the function of living, and they expend themselves in the labor of producing a quantity of wood, which represents the equivalent of matter that has changed form in the sun. The light, heat, chemical and electrical power of the sunshine have produced a certain quantity of wood, and these physical energies have been absorbed—used up—in the production of that quantity. Now, we learn that a cube of wood is the result of a fixed measure of sunshine; common experience teaches us that, if we ignite that wood, it gives out, in burning, light and heat; while a little examination proves the presence of actinism and electricity in its flame. Philosophy teaches us that the powers set free in the burning of that cube of wood are exactly those which were required for its growth, and that, for the production of it, a definite equivalent of matter changed its form on a globe ninety millions of miles distant from us.

Myriads of ages before man appeared—the monarch of this world—the sun was doing its work. Vast forests grew, as they now grow, especially in the wide spread swamps of the tropics, and, decaying, gathered into thick mats of humus like substance. Those who haves tudied all the conditions of a peat-morass, will remember how the ligneous matter loses its woody structure in depth—depth here representing time—and how at the bottom a bituminous or coaly matter is not unfrequently formed. Some such process as this, continued through long ages, at length produced those extensive beds of coal which are so distinguishingly a feature of the British and American coal-fields. At a period in geological time, when an Old Red Sandstone land was washed by ocean-waves highly charged with carbonic acid, in which existed multitudinous animals, whose work in Nature was to aid in the building up masses of limestone-rock, there prevailed a teeming vegetation from which have been derived all the coal-beds of the British Isles. Our space will not allow of any inquiry into the immensity of time required for the growth of the forests necessary for the production of even a single seam of coal. Suffice it to say that, within one coal-field, we may discover coal-beds to the depth of 6,000 feet from the present surface. The section of such a coal-field will show us coal and sandstone, or shale, alternating again and again—a yard or two of coal and hundreds of feet of shale or sandstone—until we come to the present surface; every one of those deeply-buried coal-beds having been at one time a forest, growing under the full power of a brilliant sun, the result of solar forces, produced then, as now, by chemical phenomena taking place in the sun itself. Every cubic yard of coal in every coal-bed is the result of a very slow, but constant, change of a mass of vegetable matter; that change being analogous to the process of rotting in a large heap of succulent plants. The change has been so slow, and continued under a constantly-increasing pressure, that but few of the gaseous constituents have escaped, and nearly all those physical forces which were used in the task of producing the woody matter of the plant have been held prisoners in the vegetable matter which constitutes coal. How vast, then, must be the store of power which is preserved in the coal-deposits of these islands!

We are now raising from our coal-pits nearly one hundred and ten millions of tons of coal annually. Of this quantity we are exporting to our colonial possessions and foreign parts about ten million tons, reserving nearly a hundred million tons of coal for our home consumption. Not many less than 100,000 steam boilers are in constant use in these islands, producing steam—to blow the blast for smelting the iron ore—to urge the mills for rolling, crushing, and cutting with giant power—to twirl the spindle—and to urge the shuttle. For every purpose, from rolling cyclopean masses of metal into form to weaving silky textures of the most filmy fineness, steam is used, and this steam is an exact representative of the coal employed, a large allowance being made for the imperfections of human machinery. This requires a little explanation. Coal is a compound of carbon, hydrogen, oxygen, and nitrogen, the last two elements existing in quantities so small, as compared with the carbon, that they may be rejected from our consideration. The heat which we obtain in burning the coal is almost all derived from the carbon; the hydrogen in burning produces some heat, but for our purpose it is sufficient to confine attention to the carbon only.

One pound of pure coal yields, in combining with oxygen in combustion, *theoretically*, an energy equal to the power of lifting 10,808,000 pounds one foot high. The quantity of heat necessary to raise a pound of water one degree will raise 772 pounds one foot. A pound of coal burning should yield 14,000 units of heat, or 772 + 14,000 = 10,808,000 pounds, as above. Such is the theoretical value of a pound of pure coal. Many of our coal seams are about a yard in thickness; several important seams are much thicker than this, and one well-known seam, the thick coal of South Staffordshire, is ten yards in thickness. This, however, concerns us no further than that it is useful in conveying to the mind some idea of the enormous reservoir of power which is buried in our coal formations. One square yard of the coal from a yard-thick seam—that is, in fact, a cubic yard of coal—weighs about 2,240 pounds avoirdupois; the reserved energy in that cube of coal is equal to lifting 1,729,200 pounds one foot high.* We are raising every year about 110,000,000 tons of coal from our coal-beds, each ton of coal being about a square yard. The heat of that coal is equal to a mechanical lifting power which it is scarcely possible to convey to the mind in anything approaching to its reality. If we say it is 190,212,000 millions we merely state an incomprehensible number. We may do something more than this, if we can convey some idea of the magnitude of the mass of coal which is raised annually in these islands. The diameter of this globe is 7,920 miles, or 10,880,760 yards; therefore the coal raised in 1870 would make a solid bar more than eight yards wide and one yard thick, which would pass from east to west through the earth at the equator. Supposing such a mass to be in a state of ignition, we can perhaps imagine the intensity of its heat, and its capability, if employed in converting water into steam, of exerting the vast force which we have endeavored to indicate. It was intimated last year in the House of Commons by a member of the coal commission that the decision of that body, after a long and laborious inquiry, would be that there existed in our coal-fields a supply for about one thousand years at our present rate of consumption. We have therefore to multiply the above computation by 1,000 to arrive at any idea of the reserved power of our British coal-fields. What must it have been ere yet our coal deposits were disturbed! At the time of the Roman occupation coal was used in this country. In the ruins of Roman Uriconium coal has been found. Certainly up to the present time a quantity of not less than three thousand million tons of coal has been dug out of our carboniferous deposits and consumed. All this enormous mass of matter has been derived from vegetable organizations which have been built up by sunshine. The sun-rays which compelled the plants to grow were used by the plant, absorbed, imprisoned in the cells, and held there as an essential ingredient of the woody matter. The heat, light, actinism, and electricity, which are developed when we burn a lump of coal, represent exactly the quantity of those forces which were necessary to the growth of the vegetable matter from which that coal was formed. The sunshine of infinitely remote ages becomes the useful power of the present day.

Let it not, however, be supposed that we employ all the heat which is available in our coal. All our appliances, even the very best, are so defective that we lose far more than we use. A pound of pure coal should evaporate thirteen pounds of water; in practice a pound of coal does not evaporate four pounds, even in the most perfectly constructed steam boilers, with the most complete steam engines, such as have been constructed for pumping water for the Chelsea and the other water works upon the Thames.

Numerous attempts have been made to burn our coal so as to secure a more effective result than this. There has been some advance; the most satisfactory being in the regenerative furnace of Mr. Siemens. In this system the solid fuel is converted into crude gas; this gas is mixed with a regulated quantity of atmospheric air, and then burnt. The arrangements are essentially *the gas-producer*, or apparatus for converting the fuel bodily into the gaseous state; then there are *the regenerators*. These are sunk chambers filled with fire-bricks, piled in such a manner that a current of air or gas, passing through them, is broken into a great number of parts, and is checked at every step by the interposition of an additional surface of fire-brick; four of these chambers are placed below each furnace. The third essential is the *heated chamber*, or furnace power. This, the furnace-chamber, communicates at each extremity with two of the regenerative chambers, and, in directing currents of gas and air upward through them, the two gaseous streams meet on entering the heated chamber, where they are ignited. The current descends through the remaining two regenerators, and heats the same in such a manner that the uppermost checkerwork is heated to nearly the temperature of the furnace, whereas the lower portions are heated to a less and less degree, the products of combustion escaping into the chimney comparatively cool. In the course of, say one hour, the currents are reversed, and the cold air and gas, ascending through the two chambers which have been previously heated, take up the heat there deposited, and enter into combustion at their entrance into the heated chamber, at nearly the temperature at which the products of combustion left the chamber. It is not difficult to conceive that by this arrangement, and with its power of accumulation, any degree of temperature may be obtained in the furnace-chamber, without having recourse to purified gas, or to an intensified draught. Where the temperature of the melting chamber has certainly exceeded 4,000 degrees of Fahrenheit, the products of combustion escape into the chimney at a temperature of only 240 degrees. The practical result of this regenerative system is stated to be, that a ton of steel requires by the ordinary method about three tons of Durham coke—which, being estimated as coal, will be about four tons—to melt it, whereas, in Siemen's furnace, the melting is effected with twelve hundred weight of ordinary coal. This economy is produced by reserving the heat, by means of the regenerator, which is ordinarily allowed to escape by the chimney.

Another plan for consuming coal with economy has been recently introduced by Mr. T. K. Crampton, and is now in use at the Royal Arsenal, Woolwich, and at the Bowling Iron Works, in Yorkshire. Instead of converting coal into gas, as in the Siemens process, the coal is reduced by Mr. Crampton to a very fine powder, and then blown into the heated chamber by means of a fan-blast. By this arrangement the perfect combustion of the coal is effected, and a heat of the highest intensity can be obtained. The utilization of this heat, without waste, when it is produced, is an important question still requiring careful attention. There are several other experiments being carried out with a view to the economical use of coal, but the two to which we have alluded give up to the present time the best results. Still, with these we allow more than one-half of the heat latent in the coal to escape us. The subtle element eludes our grasp—our charms are powerless to chain the sprite; he will not be bound to labor for us, but passes off into space, regardless of the human Prospero whose wand of science he derides.

In conclusion, our philosophy has enabled us to determine the heat value of our coal-fields, and to prove that all this heat has a solar origin. Our science has shown us that, although we can eliminate all this heat, we cannot use it. There is an immense quantity constantly passing into space as radiant heat which we cannot retain.

The circle of action between the vegetable and the animal world is a beautiful and a remarkable provision. The animal burns carbon and sends into the air carbonic acid (a compound of carbon and oxygen); the vegetable breathes that carbonic acid and decomposes it; the carbon is retained and the oxygen liberated in purity, to maintain the life and fire-supporting principle of the atmosphere. Changes similar to these may be constantly going forward in the sun, and producing those radiations which are poured forth in volumes, far beyond the requirements of all the planets of our system. Although there is probably some circle of action analogous to that which exists upon this earth, maintaining the permanency of the vegetable and animal world, still there must be a waste of energy, which must be resupplied to the sun.

May it not be that Sir Isaac Newton's idea—that the comets traversing space gather up the waste heat of the solar system, and eventually, falling into the sun, restore its power—is nearer the truth than the more modern hypothesis, that meteorites are incessantly raining an iron shower upon the solar surface, and by their mechanical impact reproduce the energy as constantly as it is expended?—*Popular Science Monthly.*

* Some mistake here. We have no time to cipher out the conundrum, several hasty efforts having failed. The figures follow the copy exactly; nevertheless, it is clear, according to the premises, that the yard-cube of coal is equivalent to 10,708,000 *foot-tons*.—Ed.

Creasote, Guaiacol and Phenol.

By John Williams, F.C.S.

In a recent number of the *Pharmaceutical Journal* (No. 92, third series, page 788), attention was drawn to the statement that creasote consisted mainly of a body called "Guaiacol," and which was a product of the destructive distillation of gum guaiacum. As this appeared to be a fact of some interest I determined to prepare a little of the substance and compare its properties with those of the ordinary creasote of commerce.

The process of preparing it as follows:

Gum guaiacum reduced to powder is exposed in a shallow iron pan to considerable heat, sufficient to cause the commencement of charring, and until every trace of water is driven off. We thus avoid the frothing, which otherwise renders the distillation of the gum a very difficult matter. When the mass has thus been heated for some time it is transferred to an iron retort, furnished with a long iron tube, to act as a condenser. The heat must be increased gradually to low redness, and continued as long as any tarry matter continues to distil. In this way a product is obtained amounting to about one:third the weight of the gum employed.

This tar is again placed in an iron retort and distilled, when it yields about one-third of its bulk of a light brown oily liquid. This brown oil is treated with a solution of caustic soda, which dissolves a part of the oil, but leaves a considerable quantity which must be separated and rejected. The alkaline solution of the oil is now placed in a retort and subjected to prolonged distillation, water being added from time to time, to make up for that which distils over. In this way a quantity of light oily matter passes over, having a very offensive smell, and floating on water. This is to be rejected, and when no more oil is observed to pass over, the alkaline solution in the retort is diluted, and a slight excess of sulphuric acid added, by which means a dark colored heavy oil is separated. This is distilled, and the oily product again treated with caustic soda and distilled as before, by which means a further small quantity of the light oil is separated. This alkaline solution on exposure to the air soon turns of a very dark brown, almost black color, and when an acid is added after a few days a very dark purple colored oil is deposited. This oil distilled gives a light yellowish oily liquid, which after a several distillations yields a colorless heavy oily liquid, which is the pure or nearly pure guaiacol.

Guaiacol is an oily liquid, considerably heavier than water; it is quite white when first distilled, but soon assumes a pale straw color. Its smell is characteristic of creasote, but not so disagreeable as some of the samples of that body found in commerce. The sample I have made begins to boil at 200° C., and soon rises to 210°, at which point eight-tenths distil over, and the remainder comes over at 215°. Pure creasote is stated in the books to boil at 210°. Guaiacol refracts light strongly, and has the taste as well as the general physical physical properties of creasote. It is soluble in glacial acetic acid, but insoluble in pure glycerine.

It appeared interesting to compare this body with creasote as found in commerce, more especially as some attention has lately been drawn to the fact, that creasote is sometimes sold consisting mainly of carbolic or cresylic acid, or other products of the distillation of *coal* instead of, as it ought to be, *wood*.

In commerce we find two kinds of creasote, said to be derived from wood; one well known in England, manufactured by Messrs. Morson & Son—which I shall call "English" creasote—is said to be made from Stockholm tar, and if so, is the product of pine-wood probably. The other, of German manufacture, is said to be the product of beech-wood. Of the common German coal tar creasote, I have made no special note, but have employed pure carbolic acid in all cases to represent the coal-tar or phenylic product.

English creasote commences to boil at 200°, but almost immediately rises to 213°, at which about six per cent. passes over; the temperature then rising to 216°, at which about 34 per cent. passes over; then to 222°, when about 34 per cent. again distills, and then rises to 231°, when 16 per cent. is obtained, the remainder distilling at a still higher temperature. We thus find that this is a hydrated product, and that its boiling point is considerably higher than the proper boiling-point of creasote as represented by guaiacol.

German creasote commences to boil at 200°, gradually rising to 220°, 40 per cent. comes over under 203°, 34 per cent. at 210°, and 16 per cent. under 220°, thus boiling rather lower than it should for pure creasote, but apparently not containing much of the higher homologues.

Carbolic acid (phenol) boils at 180°, and, when pure, its boiling-point is quite constant.

English creasote is insoluble in pure glycerine, as stated by Mr. Morson, in the *Pharmaceutical Journal*, No. 99, p. 921.*

German creasote is soluble in glycerine.

Carbolic acid dissolves in glycerine in all proportions.

As I have before stated, guaiacol is not soluble in glycerine; it therefore became of great interest to find out, if possible, why the German creasote should be soluble, and thus differ from the guaiacol and English creasote, more especially as I found that the addition of say 50 per cent. of carbolic acid to either guaiacol or English creasote causes them to be perfectly soluble in glycerine. It thus becomes very important that we should, if possible, devise a mode of detecting the presence of carbolic acid in pure creasote.

For this purpose recourse was had to Professor Flueckiger's process as described in *Pharmaceutical Journal*, No. 103, p. 1,008.† It consists in adding creasote (or carbolic acid) to a very small quantity of perchloride of iron in solution, then adding alcohol and afterwards diluting considerably with water. If carbolic acid alone is employed a beautiful blue color is produced, but if creasote, a dingy brownish liquid is the result. Now this test distinguishes between pure creasote and pure carbolic acid perfectly, but when I attempted to use it as a means of detecting the presence of carbolic acid in creasote it quite failed, the brown creasote reaction quite masking the blue produced by the carbolic acid. I tried various proportions, and in no instance could I obtain a reaction I could depend upon, 50 per cent. and even 100 per cent. of carbolic acid mixed with English creasote or guaiacol being quite undistinguishable. Professor Flueckiger distinctly states that his test enables us to detect the presence of carbolic acid in creasote, but I cannot agree with that statement; in my hands, at least, it does not answer.

In a recent number of the *Chemical News*, a test was given by means of bromine. When bromine water is added to an aqueous solution of carbolic acid, a white oil is speedily deposited, but when it is added to an aqueous solution of pure creasote or guaiacol, a brown oil is the result. This test, however, fails, as might be expected, to distinguish carbolic acid when mixed with creasote; in all cases a brown oil is deposited, which is useless for the purpose we have in view.

Strong solution of ammonia dissolves carbolic acid readily (the solution turning blue after a few hours' exposure to the air) while guaiacol and creasote (both English and German) are only partially soluble, or at any rate would require a very large quantity of ammonia to effect complete solution. I found German creasote to be much more soluble than either guaiacol or English creasote, namely, one-half dissolving without much difficulty, when treated with about six times its bulk of strong liquor ammonia.

The English creasote so treated did not lose above one-fourth of its bulk.

The portion of creasote insoluble in ammonia was separated; the ammoniacal solutions being diluted and neutralized with acid also deposited the creasote which had been dissolved. These different samples were examined carefully.

The English, which had been dissolved in ammonia when distilled, smelt better and more like guaiacol than the original sample of creasote before treatment; it also boiled nearer 210°, all distilling under 220°.

The portion which did not dissolve in ammonia when distilled, yielded a liquid which had a much more offensive smell and appeared to contain more of the impurities of the original creasote than the soluble portion; its boiling-point was, however, lower and almost identical with the first portion. Both samples were insoluble in glycerine. The German creasote, which did not dissolve in ammonia, retained its boiling point, but no longer dissolved in glycerine. The portion soluble in ammonia was carefully examined; its boiling-point was found to be almost the same as the normal creasote. Its smell was good; almost identical with guaiacol, but it was soluble in glycerine. Attempts made to detect the presence of carbolic acid quite failed.

Other means were then tried to procure evidence of the presence of carbolic acid in creasote.

It is stated in the paper first referred to (*Pharmaceutical Journal*, No. 92, p. 789), that while the phenol series yields with nitric acid, trinitrophenol or picric acid, guaiacol or creasote yields only oxalic acid. If this were true, we might hope to detect the presence of picric acid, and thus prove that carbolic acid had been contained in the creasote.

To determine this point, the creasote to be examined was first dissolved in about twice its weight of glacial acetic acid, and then added to an equal bulk of strong nitric acid, sp. gr. 1500. (If the creasote to be examined is added direct to the nitric acid, the action is so violent and unmanageable that no definite result can be arrived at.) The capsule containing the mixture must be placed on a sand-bath, and evaporated almost to dryness. When pure carbolic has been used, the product is a bright yellow crystalline mass—pure picric acid—but in the case of guaiacol or creasote (both English and German) the product is a brown, sticky, semi-resinous mass. This product, treated with a little hot water, is transferred to a large test tube or small retort, and a gramme or so of ordinary bleaching powder added, and a gentle heat applied, the result being the production of chloropicrine if picric acid is present, which can be distinguished without doubt or difficulty by its most peculiar and repulsive smell, or can be separated by distillation if thought necessary; but if oxalic acid is the product of the reaction, no chloropicrine is produced, but simply a liberation of chlorine. I am sorry to say that in all my trials I obtained chloropicrine, and not a trace of chlorine, and all other attempts made to isolate oxalic acid from the product of the reaction of nitric acid upon guaiacol or creasote having quite failed I have come to the conclusion that the statement respecting the different products obtained from creasote and carbolic acid by oxidation is incorrect. Picric acid, or some isomere of that body, is the product of the reaction in all cases, irrespective of the source of the creasote—or carbolic acid—being from coal-tar or from wood.

Attempts were made to distinguish between carbolic acid and creasote by the production of sulpho-conjugated acids. But the acid produced by creasote appears to be too much like the sulpho-carbolic acid for anything like a distinguishing test to be founded upon that reaction.

I regret that the results of my experiments are of a negative rather than of a positive nature, but I trust, unsatisfactory as they confessedly are, they may prove of service to any one who may wish to follow up the examination of the true nature of creasote.

There is, I think, no doubt that the English creasote is a genuine product of wood tar. It is, however, not a homogeneous body, but probably consists of several isomeric substances; while the fact of the German—beech-wood—creasote dissolving in glycerine, led me to suspect the presence of carbolic acid, but all my attempts to demonstrate its presence have quite failed, and I can only conclude that beech-wood tar yields a creasote to a certain extent different to that yielded by either guaiacum or pine-wood tar. In some of its chemical properties German creasote much nearer approaches guaiacol than the English; its smell is almost identical, and its boiling-point very much nearer and more constant.

When English and German creasote are dissolved in strong caustic soda, and then diluted, the English becomes milky, and yields, when distilled, an appreciable quantity of light oil; the German, on the contrary, remains bright and yields no oil, which would tend to prove the German to be in some respects a purer article than the English.

The fact of the German creasote dissolving in glycerine ought to be explained, either by proving that beech-wood creasote really possesses this property, or has obtained it from some peculiarity in the mode of manufacture.—*Am. Jour. Pharm.*

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* *Am. Jour. Pharm.*, 1872. 310. See also Am. Gas-Light Jour. for Oct. 10, 1872, p. 110, Excerpt 467.

† *Am. Jour. Pharm.*, 1873, 466.

Correspondence.

[Correspondents, in all cases, should sign their communications with their names and address in full—not necessarily for publication, but as a guarantee of good faith.—Ed.

Heating and Cooking by Gas.

Lower Sydenham, S. E., Nov. 5, 1872

Mr. Editor: Your correspondent "Citizen" says that with your style of gas stoves in ordinary use, there is an offensive and unwholesome odor arising from the products of combustion, and says he is at a loss to account for Mr. Hartley's silence on this point. Now Mr. Hartley stated he used a stove "with an *outlet-tube* or funnel near to or upon the top." This was of course to take off the products of combustion, and also the smell arising from the cooking; for, be it remembered, he gave his preference for the *oldest* and *simplest* forms of stoves of *wrought-iron*; but he added because they are *lighter* and *cheaper*.

Now the stoves I recommend are neither light nor cheap, but they are *effective*; and when properly adjusted by a "Gas Regulator," they give no more smell than the gas from the gaselier in the sitting room. Let Citizen order one of Wright's porcelain cooking-stoves, *used as directed*, he will find no smell and no necessity for a chimney; if a chimney *is* used half the heat from the stove escapes; that is the great objection and what gas-stove makers have striven to overcome.

"Citizen" further says—"when the burners are properly adjusted, still the moment the jets strike against a metallic substance, like the bottom of a kettle, owing to the effect produced by the contact of the gas with the metal, a pungent and disagreeable odor is emitted." Why of course there is; but you must be frightfully behind the times if poor "Citizen" cannot find in America a stove with a trivet, to keep the jets from coming in contact with the kettle, which causes the smell—we have used trivets in England for years past.

I will not take up too much of your space because you are about to bring out a pamphlet which will enighten more "citizens" than one; but I may state that Leoni's heating stoves are used in the bedrooms and halls of families in Sydenham, who would not tolerate them for one minute if they gave any unpleasant odor. I use both a Walker cookery and a Leoni heating stove, and speak not from theory but fact. What families want is not bad stoves with chimneys to protect themselves from smells, but properly constructed stoves and *gas properly applied*, so that they may be used with comfort both for cooking and heating.

Yours faithfully,
Magnus Ohren.

P.S.—I have just returned from Paris. They are much behind us in gas-stoves but beat us in coke stoves. Coke is a drug with us. M. O.

Another New Explosive: Very Irish Potatoes.

Office of Gas-Light Company of Galena,
Galena, Ill., November 7, 1872.

Mr. Editor: We had to day at Ryan's Pork House what to me appeared an unaccountable explosion. Can you through your Journal give the cause?

Twelve days since the Engineer started the works, and having heard that potatoes would keep the boiler free from scales, put half a bushel in it—used the the engine one day only. To day he opened valves, let all the water out of the boiler, took off the head of the hand hole (7 by 9) placed it against the opening, covering it except sufficient space to admit his arm. Wishing to ascertain the effect of the potatoes, he attempted to put a lighted candle in the opening, when an explosion took place, throwing his hand back with great violence, and driving the loose handhole head with such force that it buried itself two feet deep into a coal pile in the rear, shaking the whole building and filling the room with a cloud of sooty substance. The engineer says that he saw nothing in this explosion that looked like fire or blaze. As far as we can see, the boiler was not injured.

Respectfully yours,
John Lorrain.

[With our present lights, it would be vain for us to penetrate this deep mystery. We can but suggest that it was very unusual and very unhandsome of the Murphies to behave so, but lucky that they did not quite succeed in becoming devasta*taturs*. Also, we trust they will have no imitaturs.—Ed.]

Circular.

[We gladly give place to the following, which is highly meritorious in intention, and if it *should* lead to the result desired, of inducing the communication of figures sufficient to form a basis for generalizations, the latter would be extremely interesting and valuable. It must nevertheless be added that previous efforts of this kind have *not* been successful. The reasons we shall not now enter upon.—Ed.]

Office of the New Haven Gas-Light Co.,
New Haven, Conn., Nov. 13, 1872.

Mr. Editor: This Company desires to ascertain what ratio exists between the consumption of gas and the population of any given locality, with a view to determine whether there is any general law which may serve as a guide in determining the probable future demands for gas supply and storage capacity.

Will you kindly supply us with your census population in each of the decades 1850, 1860 and 1870; and also state the aggregate consumption of gas furnished by you in each of those years, as well as the largest consumption in any one day of 24 hours in each of the same years?

Any suggestions you may be able to furnish us, in view of a more complete solution of the question under examination, will be acceptable, and we shall in turn be happy to communicate to you the result of this investigation.

Yours respectfully,
F. E. Harrison, Treas.

Domestic Gas Works.

[The following letter came without distinct authorization from the writer to use his name, but as there are several points included of much interest, we have concluded to publish it. The name and address may be supplied afterwards, should we be authorized so to do. Time does not permit much comment on our own part, but we must not omit to throw in the remark that experiments on the *mixing of oxygen* with the gases the writer refers to, could not be made without *excessive danger*, unless made with a thorough knowledge of all the conditions involved, such as a skilled chemist could only arrive at as the result of some previous elaborate experiment. We must protest to our correspondent against his indulging in any such risk. —Editor.]

November 9, 1872.

Mr. Editor: Pardon me for intruding upon your valuable time with a few questions, for answers to which I would feel greatly obliged.

In using the oxy-hydrogen light, for the stereopticon, I have been in the habit of manufacturing pure hydrogen for the purpose, because I reside in the country. Recently, desiring to give an exhibition in the city (for a charitable object), I brought my hydrogen bag from the country, partially filled with the pure article, and then added to it the gas from street mains, until full. I then found the gas would not ignite at all, and I could obtain no light whatever until I combined oxygen and hydrogen at point of the blowpipe. Why was this?

My house in the country is supplied with gas made on the spot, by heated retorts, the article used being "gas oil" from petroleum distillation. This gas I have found to be too highly carbonized to use in my stereopticon, as it makes a heavy black deposit on the lime, and on the interior surface of the lanterns.)

I consume this gas through six-foot burners (instead of 1½ foot as usual), being enabled to do so by the use of "Walton's Mixer," with which, of course, you are familiar. But I find it difficult to obtain a sufficient pressure of gas in the house, unless I weight down the gasholder (the capacity of which is about 600 cubic feet, I think), and I do not like to do this lest I cause it to leak, as it is an old holder. What would be the effect if I should run in with the carburetted hydrogen, each time it is made, some pure hydrogen gas? And what would be the effect if I run in some oxygen gas instead? Would it improve the light to do either, and would it be attended with any danger? I am well aware of the danger of oxyhydrogen mixtures, but would there be any in burning it in my pipes, when under pressure in the gasholder?

Yours truly, ***

Street-Main Valves.

Mr. Editor: Allow a subscriber to suggest through your paper, to gas companies, the wisdom of placing stop valves in their distributing pipes. At the great fire in Boston, much loss might probably have been prevented, had the gas company been able to shut off the supply from the burning district, without leaving in darkness the rest of the city. Fires of more or less magnitude are constantly occurring, where waste of gas, danger or explosion, and destruction of property might be avoided, if gas companies would but expend trifling amounts in dividing their mains into several sections, so arranged that the flow of gas into any one could be suspended, while left undisturbed in the others.

Yours truly,
Verbum Sap.

Light, Heat, and Electricity from Motion.

The celebrated Jacob Perkins, when in London, in 1837, exhibited at the Adelaide Gallery the phenomena produced by the contact of soft iron with steel in motion, and which he described at the time as follows:

"The action of a soft iron disk upon hard steel, such as a file, is exhibited four times a day. This has been regularly kept up for three years, yet it has undergone very little wear. I am of opinion, in fact, that if the file had never been held upon it until it had attained its full velocity, there would not have been any loss of metal. I do not know to what extent the combustion of steel by soft iron may have been carried in the United States, but our experiments are so brilliant as to excite the highest admiration, and to induce numbers to repeat their visits to the Gallery. Our disk is a foot in diameter and an eighth of an inch thick. It requires about a three horse power to drive it, and revolves about 6,000 times in a minute. It is very accurately fitted up with friction wheels. The blaze of light, which rises about 12 inches, perpendicularly, from the point of contact, is so vivid that few persons can look steadily at it even at noon day. The stream of light is about an inch and a half thick at the distance of a few inches from the point of contact; and at the distance of 7 or 8 feet, it spreads out to about 10 inches. The sparks not unfrequently touch the ceiling, which is about 20 feet high; a ring of fire is seen all round the disk, appearing like a band of light about five eighths of an inch wide. Of what does this light consist? It is manifestly different from that of the sparks, which all fly off in a tangent. In operating with the disk, it never becomes warm; the file, however, has to be held at least two inches from the sharp end, as it becomes highly heated. The whole appearance, in fact, is very interesting, and when fully investigated, I am well convinced that some of the phenomena will be found to depend upon electricity."

[A fine pictorial representation of this apparatus while in action is given in Pepper's "Handbook of Metals."—Ed.]

The citizens of Sing Sing, through a special committee and civil engineer, are investigating the various sources in the neighborhood, for obtaining a supply of pure water for domestic and public purposes in their village. The prospects appear to be quite encouraging.

Putting Up Stoves.

We have no doubt but that a great many of our readers will find their own experience reflected in the following amusing account, by an unknown author, of a disagreeable task to be performed at this season of the year in many households:

The first step a person takes is to put on a very old and ragged coat, under the impression that, when he gets his mouth full of plaster, it will keep his shirt bosom clean. Next he gets his hand inside the place where the pipe ought to go, and blacks his fingers, and then he carefully makes a black mark down the side of his nose. It is impossible to make any headway in doing this work until this mark is made. Having got his face properly marked, the victim is ready to begin the ceremony. The head of the family—who is the big goose of the sacrifice—grasps one side of the bottom of the stove, and his wife and the hired girl takes hold of the other side. In this way the load is started from the woodshed toward the parlor. Going through the door, the head of the family will carefully swing his side of the stove around, and jam his thumb nail against the doorpost. This part of the ceremony is never omitted. Having got the stove comfortably in place, the next thing is to find the legs. Two of them are left inside the stove since the spring before; the other two must be hunted after for twenty-five minutes. They are usually found under the coal. Then the head of the family holds up one side of the stove while his wife puts two of the legs in place, and next he holds up the other side while the other two are fixed, and one of the first two falls out. By the time the stove is on its legs, he gets reckless, and takes off his old coat, regardless of his linen. He goes off for the pipe, and gets a cinder in his eye. It don't make any difference how well the pipe was put up last year, it will be found a little too short or a little too long. The head of the family jams his hat over his eyes, and, taking a pipe under each arm, goes to the tinshop to have it fixed.

When he gets back, he steps upon one of the best parlor chairs to see if the pipe fits, and his wife maker him get down for fear he will scratch the varnish off the chair with the nails in his boot heel. In getting down, he will surely step on the cat, and may thank his stars if it is not the baby. Then he gets an old chair, and climbs up to the chimney again, to find that, in cutting the pipe off, the end has been left too big for the hole in the chimney. So he goes to the woodshed, and splits up one side of the end of the pipe with an old axe, and squeezes it in his hands to make it smaller. Finally he gets the pipe in shape, and finds that the stove does not stand true. Then himself and wife and the hired girl move the stove to the left, and the legs fall out again. The next move is to the right. More difficulty with the legs. Moved to the front a little. Elbow not even with the hole in the chimney, and he goes to the woodshed after some little blocks. While putting the blocks under the legs, the pipe comes out of the chimney. That remedied, the elbow keeps tipping over, to the great alarm of his wife. He then gets the dinner table out, puts the old chair on it, gets his wife to hold the chair, and balances himself on it to drive some nails in the ceiling. Drops the hammer on his wife's head. At last gets the nails driven, makes a wire swing to hold the pipe, hammers a little here, pulls a little there, takes a long breath, and announces the ceremony completed.

Job never put up any stoves. It would have ruined his reputation if he had.

[True, every word of it. We know how it is ourselves; in fact, wish we had as many dollars as we knew so. But how about *gas-stoves*.—Ed. Am. Gas-Light Jour.]

Dangers of Gas During Fires.

[This subject has received much attention, and will receive more, from the writers for the daily press, in connection with the Boston conflagration. Without endorsing the exaggerations which are current, we give place to a paragraph from the correspondence of the *New York Times*, in the hope of initiating useful discussion.—Ed.]

"When a fire catches in a building what happens? If it is near a gas meter or a gas burner it takes but a short time to melt off the fixture, and if it is further off but a short time longer, and a volume of gas is poured into the building, the supply of which is continued so incessantly as to render futile all attempts of the firemen to put it out. Even if the wind should blow it out the flames would instantly relight it; and as this occurs on every floor, the fixtures being distributed everywhere, and in some buildings meters being placed in every office, the whole building becomes finally filled with a material so inflammable that nothing can put it out. Of course, under such circumstances, the whole interior of the building, together with the contents, would be burned, and it would only require that the accumulation of gas should be sufficient, with the heat, to make the building explode, or the existence of Mansard roofs on the adjoining buildings, with a moderately high wind, to secure a general conflagration. People would be thought lunatics who should lead a train of gunpowder into their stores, and conduct it along under all the floors, and behind all the wood-work of the doorjambs and wainscoting, so that, if an accidental fire should break out, it would be sure to be ignited; but this would be a perfectly sane proceeding in comparison with doing the same thing with a highly inflammable gas—the gunpowder would simply explode, and the mischief would end with the consequences of the explosion—but with gas, the supply would be continuous, and all efforts to put it out would be vain. The remedy I propose is, to force all the gas companies by law, to place a stop cock on the sidewalk, or anywhere outside, such as we have for the Croton water, and let it be the first duty of the Fire Department, on arriving, to turn off the gas. I propose that the placing of the stop-cock should be obligatory upon the gas companies, and be paid for by them, for the following reasons: First, The stopping off the gas accrues to their benefit, inasmuch as it prevents the tremendous waste of gas that they would otherwise be subjected to; and, secondly, because they are bleeding the community to such an extent by their monopoly (their dividends to their stockholders being so large, that they either dare not, or are ashamed to publish their amount) that they can well afford to make the outlay of placing the stop-cocks."

A New Preventive of Boiler Incrustations.

[The following item was put in type by mistake for another selection. Further, to avoid all possible misconstruction, we are glad to make this an opportunity to add, that it is our practice, founded on both science and experience, to look upon all such prescriptions as this for doctoring steam boilers, as nothing more than nostrums, no better than "old wives fables."—Ed.]

An English paper says a new means of preventing the incrustation of steam boilers has been recently discovered in a plant which has hitherto been regarded as but of little value. This is the *Arctostaphylos Uva-ursi*, commonly known as the bearberry and the bear's bilberry. The leaves of this plant are employed in Russia and Sweden for tanning leather and for dyeing, as they yield a kind of ash color. They were formerly used in this country as a remedy for the stone, and are still held in some estimation for that purpose in America. They are scentless when fresh, but when dry and powdered, emit an odor somewhat like that of hay; they are bitter and astringent to the taste, and contain tannic and gallic acids. We do not know whether the fact that they were used as a medicine for the removal of calculi suggested their employment as a preventive of scale in boilers, but a preparation has lately been brought into notice under the name of Armitage's Vegetative, which is said to effectually cleanse steam and other boilers from scale, no matter how thick. The preparation consists merely of the leaves of the bearberry, which are powdered and placed in the boiler that is coated with scale. It is said that the preparation speedily effects the removal of the latter, which can easily be blown out: and this accomplished, all the incrustation in the future may be prevented by supplying the boiler with a weekly dose of from 20 lbs. to 24 lbs. per 40-horse boiler. Specimens of the preparation and of the "scale" removed by it are exhibited at the Kew Museum.

It is said that the discovery of this alleged property of the bearberry leaves was purely accidental; a quantity having been boiled in an old boiler with the idea of extracting a dye color, it was found that the scale was loosened and readily removable. The bearberry is a shrubby trailer, with dark green leathery leaves, broad at the upper end. The flowers are white, flushed with pink; the berries small and red, like those of the hawthorn. Quantities of these leaves might be gathered in many districts at a merely nominal cost, and their capability of removing scale conclusively tested.—*Amer. Artisan.*

Explosion at the Brooklyn Navy Yard.

At half past one o'clock on Saturday afternoon, November 23d, an explosion took place at the Navy Yard. It fortunately happened that no one was seriously hurt, and that the fire was quickly extinguished. Upon inquiry it appears that about a month ago a large force of men were employed in finishing the new machine-shop and laying the gas, which operation had not been completed at the time of the discharge last week. At that time one of the gas pipes had been plugged up very insecurely, and for the last two days the gas had been escaping and accumulating in the building. Yesterday when about to resume work the men were unable to enter, owing to the large amount of gas escaping, and, in order to find out the leak, one of the employees entered the building with a naked lamp. An explosion instantly took place, blowing the glass and windows to pieces, and setting fire to the building. By the prompt attendance of three steam fire engines from the yard the fire was quickly extinguished.—*N. Y. World.*

A Good Thing Started.

We took occasion in a recent issue to speak of the miserable lettering of the street names upon the lamps of this city. Last evening there was an exhibition at the corner of Fifth avenue and 23rd street (Fifth avenue Hotel), of a new improvement, which seems to meet the wants of the people—the addition of a circle (or band) of ground glass raised upon the globe of the newly adopted "Boulevard" lamp—Bartlett's patent—above the light, gives a prominent place to the name of the street. The letters, three inches in height, in round-faced characters, stand out boldly, and when it is done throughout the streets, New York will be the best lighted and best street-lamp-directed city in the Union.—*N. Y. Commercial Advertiser. October* 26.

Fuel in Europe.

While alarm is felt in England, France and Germany lest there should be a failure of fuel through the exhaustion of the coal-beds of Europe, a similar fear begins to prevail in Russia, which depends almost wholly upon wood. The rapidity with which the forests are being cleared in some of the provinces threatens a severe and not very distant scarcity of the indispensable material. Some of the papers propose to substitute coal for wood in the production of steam, and blame the railways for using the former when they might employ a mineral combustible. The *Exchange Gazette* lately printed a series of articles on the subject. According to these the cost of wood for building and heating purposes on the banks of the Volga has advanced almost a hundred per cent. The same quantity that brought from 4,000 to 5,000 roubles in 1865 is now worth from 8,000 to 9,000. Experiments in the neighborhood of the Volga in 1863 in search for coal gave no result. But other mineral combustibles have been found in some quarters near the same river. There is a quarry in the province of Samara which supplies a combustible schist contain-

[*For continuation see page* 190.]

THE AMERICAN

GAS-LIGHT JOURNAL

AND

Chemical Repertory,

PUBLISHED ON THE 2D AND 16TH OF EACH MONTH,

At No. 42 Pine Street, New York.

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MONDAY, DECEMBER 2, 1872.

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS*, or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

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THE McILHENNY METHOD OF WORKING RETORTS.

The cut on our first page, illustrating this invention, is the feature of this issue of the Journal. It has been the good fortune of the Editor to have made with the last few weeks visits both to Washington, D. C., and to Portland, Me., where this method is in use altogether, and to have examined, particularly at the latter place where time was more favorable thereto, into the details and results of the working of the plan.

Both at Washington and at Portland, the drawing and charging of benches of retorts were repeatedly witnessed, and the extreme cleanness and freedom from carbon-incrustation, claimed as the effect, pre-eminently, of bringing the vacuum to bear *directly* on the interior of the retort during carbonization, could not fail to be recognized at once. At Portland, however, the investigation was followed up very much further, the quality of the gas being tested with great care. (It may be well to remark here, to obviate possible cavil, that my visit, though expected by Mr. Yorke, the Engineer of the works, was made nevertheless *a day sooner* than he expected, and took him by surprise).

The photometric observations were begun by a careful verification of the photometer bar and the clock, the bar being found to be in error to the extent of about half a candle, throughout that part of the graduation covered by the range of the observations.* This was rectified. The photometric observations were made at intervals during two days, Nov. 12th and 13th, the results being very uniform, and the mean of the whole, reduced to 120 grains sperm per hour, was 17·46 candles. The burner, the only Argand we had, was by no means favorable to the gas, being adapted for 14 candle gas, and this gas when burning 5 feet frequently tailed up above the chimney. The candles were weighed delicately, and the rate of sperm consumption determined by burning a whole hour at a time.

During the two days the gas made was 358,000 feet, and the coal used, 73,200 lbs. of a mixture of half Youghiogheny and half Despard, with 4½ per cent. of grahamite ("Ritchie"). This is equal to 4·89 feet of gas per lb. of coal, and if calculated to the "standard volume" or 9,500 feet of gas per long ton, is equivalent to 20·13 candle gas. It is proper to add that the Despard was of last year's stock (though under cover) and had of course deteriorated somewhat. The remarkable character of the figures need not be dwelt upon. Many may regard them with incredulity, but "seeing is believing," and the writer saw it done.

It will be observed, by those who read the specifications, that the whole operation which results in so great a gain in candle power consists in reality simply in the opening and shutting alternately of two stop-cocks, the one in the larger or tar pipe being opened, and the other in the water pipe shut, just after closing the lids of the charged bench; that in the tar pipe being shut and the other opened, just before opening the retorts to draw. The result is that the tar and water flow off in the first case, removing the seal from that section of the main, allowing the exhaust to act freely, steadily, and *directly upon the charge*, and not, as usual, only to diminish the water pressure at the dip, and cause but an indirect, imperfect, and fitful relief to the expansion of the gas in its formation from the coal.

Objections have been urged that there is *danger* in this mode of operation, arising from introduction of air, through mistake or carelessness. I found that in practice such mistakes do not occur, the system being so easily learned that the men soon get to operating the cocks mechanically at the proper time, without deliberation. The writer stood by while a bench was opened without restoring the seal. At once a curious sound was heard, which serves *as an alarm*, the intermittent motion of the exhaust, as conducted through the open stand-pipes. Gross carelessness only, such as would blow up *any* gas works, at any time, could give rise to danger.

A curious experiment of Mr. Yorke was the attaching of a pressure gauge to the lid of a retort while in operation. It showed oscillations, of course, corresponding to the motions of the exhauster, but these were *equal in each limb*, showing beautifully that notwithstanding the continual evolution of the gas, the pressure inside was kept exactly equal to that of the atmosphere outside. Mr. Yorke states that under such circumstances it is far easier to get up and to keep up the heat of a bench, and this he states to be independent of the manifest advantage of the prevention of incrustation.

The Editor has further facts and figures to put before the fraternity, in relation to this improvement, but these must go over till another time.

* This verification of the bar of the Bunsen photometer cannot be too strongly urged upon photometrists, both as to the total length of 100 inches, from centre to centre of lights, and as to the subdivisions. A useful table is given by Hughes, p. 281. A *standard* measure must of course be used, if attainable. The work is one sometimes requiring considerable nicety and complex calculation. H. W.

EFFLUVIA FROM GAS-FLAMES: ARSENIC.

It will be observed that in this issue our British correspondent, Mr. Ohren, upholds, with a strong pen, the inutility of attaching flues to gas stoves, when the latter are properly constructed; in opposition to the views of our other esteemed correspondent "Citizen." As we are not yet quite ready for our own complete say on this subject, we shall leave it for present discussion to these two mutually worthy antagonists, our present object being to take up briefly another point raised by "Citizen" in the communication to which Mr. Ohren takes exception. "Citizen" says that "sometimes the most noxious vapors—the vapors of arsenic, for example—have been found in the products of combustion." Now, it seems to us that this admission, from a pen manifestly familiar with gas subjects, has at least a potentiality for much mischief; and we therefore seize on the opportunity to show that in this country, at least, or throughout an immense portion of this continent, all apprehensions that might be founded on such a dictum may be cast to the winds.

Going the rounds of our recent exchanges, all over the world, is the following item:

Arsenic in coal soot has been observed by H. Reinsch, who found it to contain also iron, manganese and copper. 272 grms. soot strongly compressed, evolved on incineration, first, the odor of bitter almonds, then of arsenic, afterwards of sulphurous acid, and left 166 grms. of red brown ashes, in which traces of arsenic were still observed.—*N. Jahrb. f. Pharm., July* 18–20.

Now this alleged observation may be authentic or it may not; but, even admitting it as such, it is by no means incredible, inasmuch as it is well-known that throughout the rocks of Europe, *iron pyrites* is scarce ever found free from traces of arsenic, insomuch that all the sulphuric acid made in Europe nowadays contains arsenic.

Very different considerations, however apply to our American coals. Not only is there no case

on record of the detection of arsenic in an American coal, or in the pyrites that accompanies our coal beds, but the rocks from the ruins of which our Carboniferous beds were built up, though loaded with metallic sulphurets, are characterized by an extraordinary and unusual freedom from arsenic. This fact was first pointed out by the present writer as remarkable, in a paper read to the American Association in Baltimore in 1858; that is, the extreme rarity of localities of arsenical minerals in our crystalline schists. Any fear of arsenical fumes from American coal gas would be therefore unreasonable and chimerical.

THE BOSTON FIRE AND THE GAS COMPANY.

The Editor of this Journal happened to be in Boston during the closing scenes of the great fire, and again a few days subsequently. The scene of the night of Monday, the 11th Nov., will not soon be forgotten by him. Explosions, and rumors of explosions, had led to the peremptory turning off of the gas at the holders, from the whole city. The sky was overcast, and the throngs of populace in the streets groped their way in many places through inky blackness. The shops were all closed, and here and there only, at the street stands, a dim candle or a flaring vapor-lamp or naphtha-torch would be dimly or fitfully visible. After this aftertaste of the joys of the merry times of yore, before gas shed its rays over benighted cities, the Hubites at least are not likely soon to clamor for the abolition of their gas works, as a "common nuisance," in emulation of some of our lately-baffled grumblers of Gotham.

The Editor had the pleasure of a very hasty interview with Mr. Greenough, the Manager of the company, notwithstanding the overwhelming burdens cast upon him by the emergency, burdens which were of course greatly aggravated by the recent sudden death of his superintendent, Mr. Giles, who has been for near twenty years the faithful and reliable stand-by of this important company in all time of trouble. Mr. Greenough stated that the fire found them with about 3½ millions of gas in their holders, of which they did not *lose* more than ten per cent. as he believed, a fact under the circumstances, very remarkable.

One of the most important lessons, he said, taught by the event was the worthlessness in such times of trial of any form of water-valve for street mains, and the necessity of immediate and universal substitution of some form of gate-valve or other metallic arrangement.

This seems obvious, and we may here add that on this head we have several communications from correspondents, relating to different forms of such valves, that are before the public, and to which we propose to give attention as soon as possible. We shall have more to say about the Boston conflagration.

COKE AND COAL SCREENING SHOVELS.—We would call the attention of gas companies generally, to the fact that a new improvement has been effected in the manufacture of Sabbaton's coke and coal screening shovels, whereby they are rendered lighter and more durable.

To Gas Companies.

AN AMERICAN ENGINEER,

who has for many years made Gas a specialty, during which time he has built and managed a number of Works, and is now running one designed and built by himself, desires to change, for reasons which will be given at interview.

Unexceptional refetence furnished as to ability and business qualifications.

☞ Would run a Works by contract or lease.

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A NEW INVENTION FOR LIGHTING STREETS.

Gas Engineers,
Gas Companies,
Officers Having Charge of Lighting the City,
Scientific Men,

and those who pay taxes for lighting our highways, are invited to examine a new invention, patented by M. B. DYOTT, which has the following points of excellence and superiority over all other means of street illumination. It doubles the power and efficiency of the gas used in it. *One* lantern with a 5 or 6 foot burner is superior to *four single top* lanterns, in which 3 or 3½ foot burners can only be used with safety (a larger burner will so heat the glass that rain will break it). It is an established fact, that one 5 foot burner will give more light than three that consume 3 feet each, or 9 feet of gas.

DYOTT'S patent **Luminous Reflecting Street Lamp** has a beautiful semi-transparent opaline PROTECTOR and REFLECTOR, which never loses its brilliancy, throws a softened light upon the upper portion of the buildings, and reflects the light, which is in all other lanterns wasted in lighting the sky, beneath, around, and where it is wanted. The top of our "CHAMPION LANTERN" being *double* the intervening air space, keeps the opaline dome cool, no matter what heat and light may be put in it, and cannot be broken by inclemency of the weather. Upon this semi-transparent dome is displayed the names of streets so distinctly, that they can be read at a great distance. The globe is egg-shaped—the strongest of formations. The lantern is so constructed, that three of them can be cleaned in the time required to clean one of the old style. They are made of copper, brass, and iron, and are ten times more durable than those now in use. Being the most durable and efficient, they are the most *economical*, and being the most beautiful, are an ornament to the city.

We are prepared to furnish these lamps, or to negotiate with Cities or Corporations, for the right to make and use them, and will be pleased to furnish any information, and illustrated circulars, upon application personally or by letter to

M. B. DYOTT,
114 South Second Street,
Philadelphia, Pa.

Those who desire to participate in forming a Company to manufacture and handle this invention, or to purchase rights, will address as above. 310

FOR SALE,
50,000 TONS OF GAS CANNEL.

E. FOSTER & CO.,
COAL CANNEL AND IRON MERCHANTS,
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E. FOSTER & Co. have for sale Fifty thousand tons of Gas Cannel for delivery over next year. Analysis, 10,000 cubic feet of gas per ton. Illuminating power 23 candles. Coke 12 cwt.

Coals of all descriptions shipped from any port.

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CLAY AND IRON RETORTS SET,
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GEO. A. McILHENNY'S
PATENT
VACUUM PROCESS,
FOR RELIEVING GAS RETORTS FROM PRESSURE.

Patented in the United States and Great Britain, June 1867, first patent for this purpose in the United States (but not presented to the public until fully tested). Now in successful operation for six years, with most satisfactory results.

The many devices lately brought to the notice of the American public, to accomplish the same results are mostly old English contrivances tried and abandoned years ago, on account of the machinery, stuffing boxes, valves, levers, etc., necessary

But the extraordinary results obtained by the McIlhenny process, have induced some unprincipled persons to bring to the notice of the public, as *recent inventions of their own*, some of these old devices; their purpose seems to be simply to evade the patent.

This process is not only safe, simple and effective, but costs little to apply. The only machinery necessary is a one and a half inch stop cock, and a half inch stop cock to each bench. No alteration in the old system is required. In fact, a Works operated with this process, can at any time be operated on the old pressure system, simply by closing the two stop cocks above mentioned. There is nothing to get out of order, nothing that requires special attention; no stuffing-boxes to pack and keep tight, no valves to keep clear of tar and pitch, no levers to lubricate, and no expense for a great amount of machinery.

The McIlhenny process challenges the world as regards yield and quality of gas.

For particulars apply to GEO. A. McILHENNY, Engineer of the Washington Gas-Light Co., Washington, D. C., or to WILLIAM YORKE, Engineer of the Portland Gas-Light Co., Portland, Me., who will take pleasure in corresponding with any one interested. 307-1y

RETORTS AND PIPES FOR SALE.

Three new Iron Retorts, never used. Mouth-pieces, Stand Pipes and Bridge Pipes complete (Sixes) for three Benches of Retorts (Three's). Have remodeled the Works and got in new patterns. Will be sold at half the price of new ones Address

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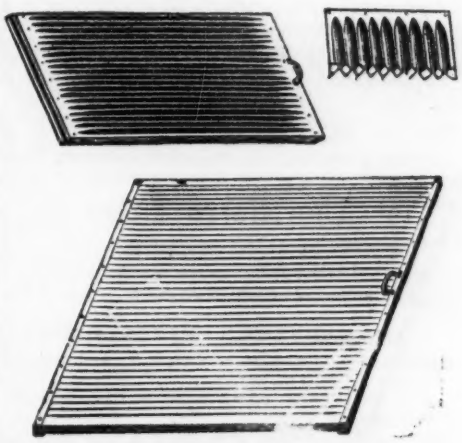

To Gas Companies.

The above Trays will last longer, and are cheaper than any Tray now used. They are now made without any outside strips, which gives more purifying surface, being perfectly smooth. The lime will not adhere to them as in other Trays. They are now used in over three hundred Gas Companies in the United States, and other places.

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CINCINNATI, OHIO.

☞ We are now prepared to furnish Glycerine to Gas Companies, etc., for filling Meters.

☞ Orders promptly executed. 306-3m

ing a large amount of inflammable gas. The compulsory use of this substitute for wood is advocated. Meantime a meeting of proprietors and sylviculturists is being held at Moscow, and it is expected that stringent rules will be adopted by them to regulate and moderate the felling of wood for railways, distilleries, and sugar manufactories, which are at present consuming at a rate that heralds speedy exhaustion.—*Pall Mall Gazette.*

RENEWAL OF THE FIRE AT THE CHICAGO GAS COMPANY'S COAL YARD.—CHICAGO, November 23.—The fire which has been burning slowly from spontaneous combustion since Wednesday evening in the North Side Gas Company's coal yard has broken out afresh. About $2,000 worth of coal has already been destroyed, and it is feared that all the coal in the yard will be consumed.

PRICES OF FOREIGN AND DOMESTIC GAS COALS.

[Reported Expressly for this Journal.]

DECEMBER 2, 1872

DELIVERED IN NEW YORK.

English Cannel.			
Ince Hall	$13 50	@	14 00
Kirkless Hall	13 00	@	13 50
English Caking Coals.			
Newcastle Gas	$7 50	@	8 00
Liverpool caking	7 25	@	7 50
British Province Coals.			
International—At Mines, $2 00 in currency			— —
Block House—At Mines, $1 50, Gold			6 25
Little Glace Bay—At Mines, 1 00 Gold			— —
Pennsylvania Coals.			
Penn Gas Coal—At Amboy	$6 75	@	0 00
Westmoreland	6 75	@	0 10
Shafton	6 00	@	0 00
Youghiogheny—At Baltimore	5 50	@	0 00
West Virginia Coals.			
MurphyRun	$6 75	@	0 00
Despard	6 75	@	0 00
West Fairmont	6 87½	@	7 00
American Gas Coal	6 62½	@	6 75
Fairmont	6 75	@	0 00
Newburgh Orrel	6 75	@	0 00
Pinnickinick	6 75	@	0 00
Cloverhill of Virginia	5 25	@	5 50
McKenzie Compound Mixture			8 00
American Cannel Coals.			
Peytona of West Virginia	$14 00	@	14 50
Darlington of Pennsylvania			— —
American Cannel	$10 00	@	10 00
Asphalts.			
Albertite of New Brunswick	$18 00	@	18 00
Ritchie Mineral of West Virginia	17 10	@	00 00
Trinidad Bitumen	— —	@	14 05

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AMERICAN

GAS SCREEN MAN'F'G COMPANY.

TO GAS-LIGHT COMPANIES.

Your attention is respectfully called to the GAS SCREEN now being manufactured by the American Gas Screen Manufacturing Company, under the patents granted to E. DUFFEE, and are pleased to submit the following points of their excellence and superiority over all other screens now in use.

The Screen is made with an oak frame, interlaced with split rattan, drawn through holes at regular intervals in the Frame and cross-pieces. the edges of the frame being grooved to prevent abrasion.

The advantages of the screen are:

1st. The large purifying surface, the construction of the Screen giving over three-fourths of the surface for the gas to penetrate the lime.

2d. On account of the free passage of the gas through the Screen the pressure is reduced, thereby preventing the accumulating of carbon on the retorts.

3d. The saving of lime and labor, as the Screens are not liable to clog, and are easily cleaned.

4te. Their cheapness and simplicity of construction.

5th. Their DURABILITY—they can be used longer than any other now used.

Testimonials.

PROVIDENCE, RHODE ISLAND, March 21st, 1872

LUTHER DAY, Esq., Agent, etc.

Dear Sir: The Trays manufactured by you for our West Station were put in use in September last, and have *given perfect satisfaction.*

The frames are well put together, and I see no reason why they will not last for a long time. The *very large amount of open space* in these Trays gives the gas an easy passage, and brings it into contact with the lime much better than when the space is so contracted, as is the case in most of the other Trays in use.

The pressure thrown upon the retorts by contracted passages is very great and were gauges used more frequently than they now are in many gas-works, this facat of having *open Trays* would become more apparent to mangers of gas works. The digerence in pressure at this station in passing the gas through your purifiers, is two-tenths (2-10) inches.

The amount of gas purified. per bushel of lime used to this date, is six thousand five hundred and fifty six (6,556) cubic feet.

Respectfully yonrs,
JAMES H. ARMINGTON, Supt.

BOSTON GAS-LIGHT CO., Dec. 1871.

Dear Sir: In answer to your inquiry how we like your Patent Tray for dry gas purifiers, I take pleasure in saying we have used them exclusive of all others, for the last three years. and think them far ahead of any yet offered. The surface being nearly three times that of any other Tray, and their lightness and durability perfectly satisfactory.

Yours respedtfully,
A. M. GILES.

EDWARD DUFFEE, Esq.

EAST BOSTON, JUNE 15, 1871.

Gentlemen: We have used your Screens some five years. They give perfect satisfaction.

I consider them *by far the best Screen* for Dry Lime Purifiers I have seen. Yours truly, A. M. NORTON, Supt.

CHELSEA, May 1, 1871.

Mr. E. DUFFEE.

We are using your Purifying Trays, and find them to be the *best of any* that I have used, and will *purify more gas with less pressure* than any tray that I know. I can fully recommend them, after four years trial, to any Gas Superintendent with perfect safety, as the *cheapest and best Tray made.*

Yours truly, JOHN ANDREW, Sup't.

DORCHESTER, March 3. 1870.

Mr. E. DUFFEE.

Dear Sir: We have had your Gas Trays in constant use for almost one year and six months, and find them superior to any others we have ever used, both in point of economy and efficiency. Truly yours, W. B. BROOKS,
Agent Dorchester Gas-Light Co.

JAMAICA PLAINS, MASS., June 21, 1871.

EDWARD DUFFEE, ESQ.

Dear Sir; The Trays ordered by this company three years ago, are getting somewhat worn. I wish to say here that I consider your Trays to be superior to any yet invented, therefore please make us another set at the price named, to be like the sample shown in every way, and oblige Yours truly
JAMES F. ROGERS,
Sup't Jamaica Plains Gas-Light Co.

BROOKLINE, June 11, 1871.

E. DUFFEE, ESQ.

Dear Sir: You will please make a set of Gas Trays for this company as soon as convenient, at price named. In regard to the merits of the Tray, after having them in constant use for over two years, I will say that I consider them *superior to any Tray* manufactured in this country. Respectfully yours,
H. A. ALLYN,
Sup't Brookline Gas-Light Co.

BANGOR, August 2, 1870.

EDWARD DUFFEE, ESQ.

Dear Sir: Yours of the 20th ult. is received. In regard to your Gas Trays, I take pleasure in saying that they have been in use over two years, and have given perfect satisfaction and they are in good order at the present time; should have no hesitation in recommending them, believing they are the most durable and easiest kept in order of any with which I am acquainted. Respectfully yours,
W. H. PERRY, Sup't.

OFFICE OF THE SPRINGFIELD GAS-LIGHT CO.,
SPRINGFIELD, MASS., Oct. 10, 1871.

Mr. WARD,
President Hartford Gas-Light Co.

Dear Sir: I have been using Gas Screens made by the American Gas Screen Company, for nearly a year, and find them superior in every way to the wooden Screens made and formerly used by the Springfield Gas-Light Co. I can purify more gas with the same quantity of lime, there being more surface to the Screens; and I consider them more durable, and recommend them to your consideration.

Yours with great respect,
GEORGE DWIGHT.

ROXBURY, June 14, 1872.

EDW. DUFFEE, ESQ.

Dear Sir: In answer to your inquiry regarding your Patent Gas Screens, I am happy to be able to say, that after nearly three years constant use we are perfectly satisfied with them being able to purify over fifty pet cent. more gas with them, than with any other Screen we have used.

Yours respectfully,
THOMAS J. PISHOU.

OFFICE DETROIT GAS-LIGHT CO.,
DETROIT, MICH., April 22, 1872.

AMERICAN GAS SCREEN MANUFACTURING CO.. HAVERHILL.

Gentlemen: The Screens bought of you work far better than any we have ever used. As a proof, we have with the same quantity of lime purified *twenty per cent.* more gas with your Screens than with any others, and the work well done. The workmen are also better pleased with them—they being light and handy to work. They also relieve the pressure very much upon the retorts, and I cheerfully give yau my experience. Yours truly,
P. E. DEMILL. Secretary.

We give a list of some Gas-Light Companies using them.

Providence, R. I. Gas-Light Co.. Boston, Mass. Gas-Light Co.: East Boston, Mass., Gas-Light Co.; South Boston, Mass., Gas-Light Co.; Springfield, Mass., Gas-Light Co.; New Bedford, Mass., Gas-Light Co.; Manchester, N. H., Gas-Light Co.; Reading, Penn., Gas-Light Co.; Biddeford, Me., Gas-Light Co.; Hartford, Conn., Gas-Light Co.: New Haven, Conn., Gas-Light Co.; New Orleans, La., Gas-Light Co.; Savannah, Ga., Gas-Light Co.; Charleston, S. C., Gas- Light Co.; Trenton, N. J., Gas-Light Co.; Charlestown, Mass., Gas-Light Co.; Dorchester, Mass., Gas-Light Co.; Chelsea, Mass., Gas-Light Co.; Baltimore, Md., Gas-Light Co.; Manhattan, N. Y., Gas-Light Co.; Cincinnati, Ohio.; Gas-Light Co.: San Francisco, Cal., Gas-Light Co.: Albany, N. Y., Gas-Light Co.; Sacramento, Cal.; St. Joseph, Mo., Gas-Light Co.; Leavenworth, Kansas, Gas-Light Co.; Macon, Ga., Gas-Light Co.; Roxbury, Mass, Gas-Light Co.; Lansinghburg, N. Y., Gas-Light Co.; Bridgeport, Conn., Gas-Light Co.; Stamford, Conn., Gas-Light Co.; Poughkeepsie, N. Y., Gas-Light Co; Scranton, Penn., Gas-Light Co.; Lewiston, Me., Gas-Light Co., and one hundred others.

Address **A. P. JAQUES, Treas.,**
Amer. Gas Screen Man'f'g Co., Haverhill, Mass.

WILLIAM FARMER,

ARCHITECT AND GENERAL GAS ENGINEER,

111 BROADWAY, TRINITY BUILDING, Room 95, New York.

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Dumping Barrows for Coal, Coke and Lime,
Blowers for Forgers,
Pumps for Water, &c., &c.

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SAMUEL DOWN, President American Meter Company, N. Y.
C. VANDERVOORT SMITH, Engineer Manhattan Gas-Light Company, N. Y.
CHARLES MOWTON, Engineer New York Gas-Light Company, N. Y.
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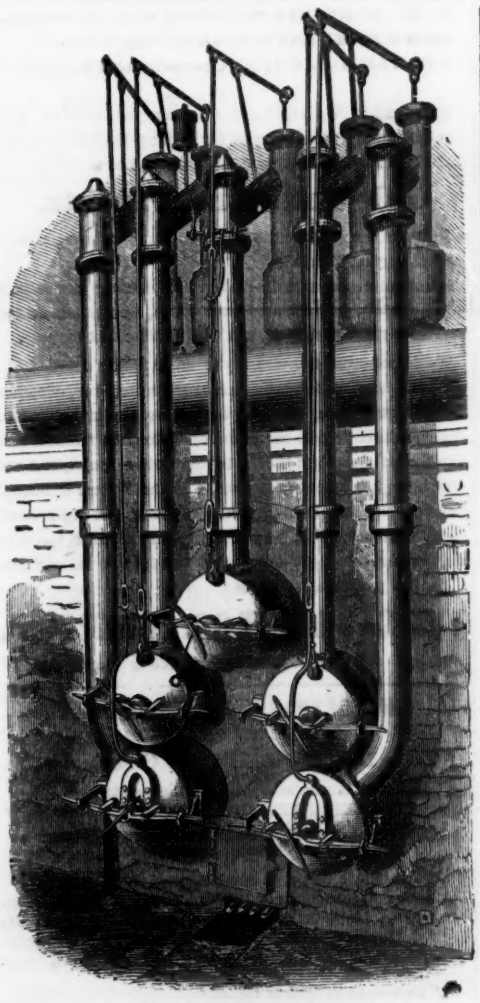
PETER F. BURTIS, Supt. and Engineer, Chicago Gas-Light Co., Chicago, Ill.
JAMES R. SMEDBERG, Consulting Engineer, San Francisco Gas-Light Co., Cal. [254-



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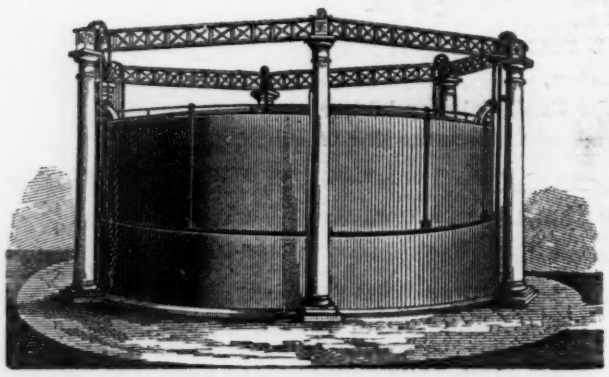

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Franklin Woolman, Burlington Gas Co., N. J.
O. W. Goodwin, Camden Gas Co., N. J.
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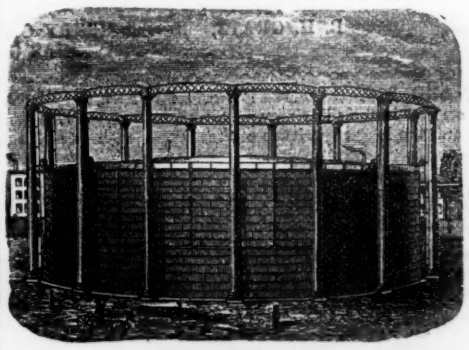

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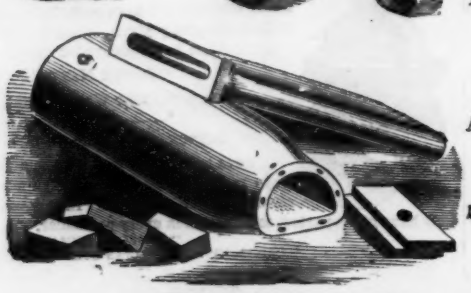

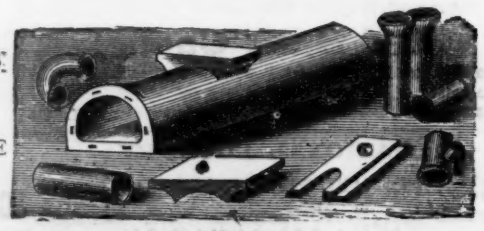

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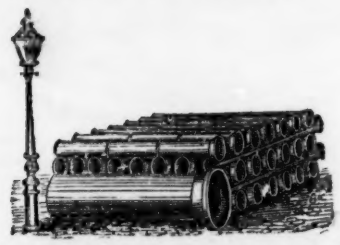

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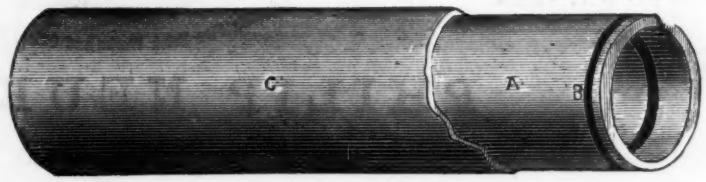

FIG. 2.

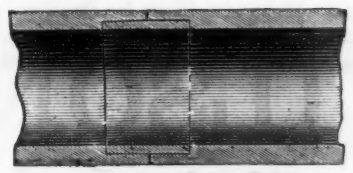

FIG. 3.

A—Cylinder of Wood. B—Band of Iron. C—Coating of Hydraulic or Asphaltum Cement.

FIG. 2.—Thimble for Connection. FIG. 3·—Horizontal Section and Connection.

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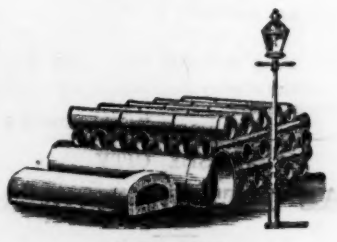

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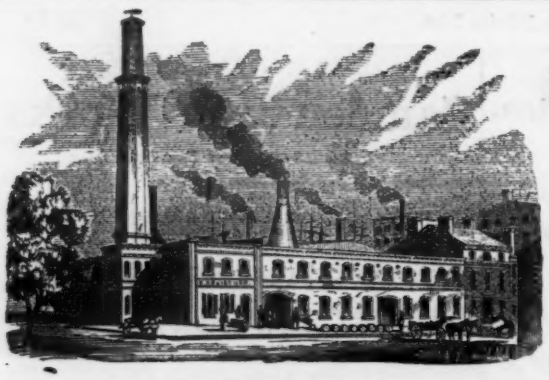

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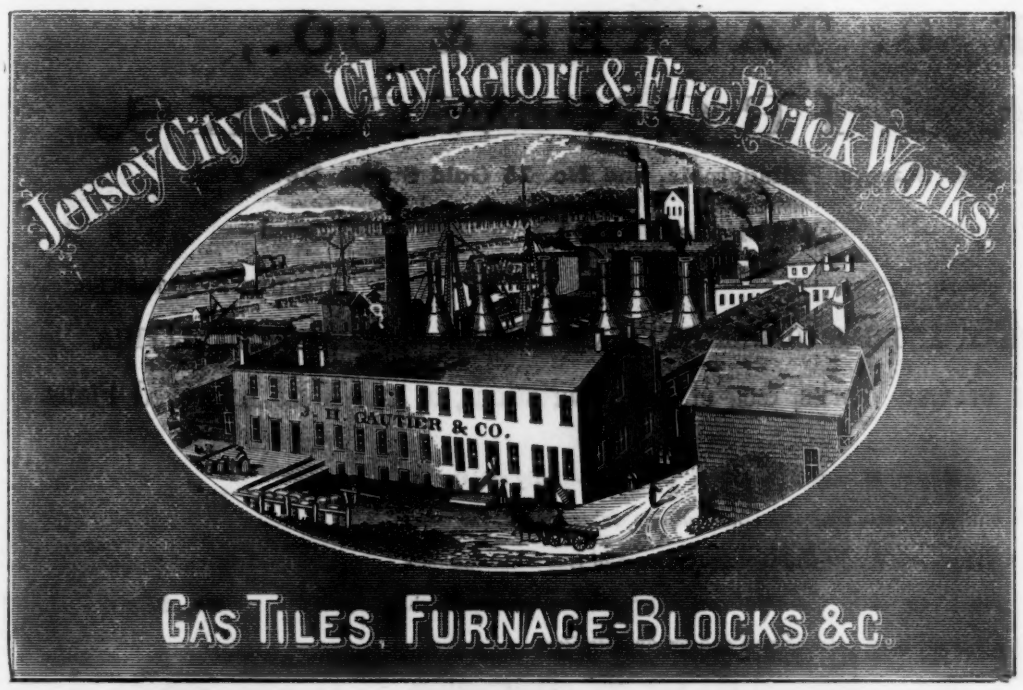

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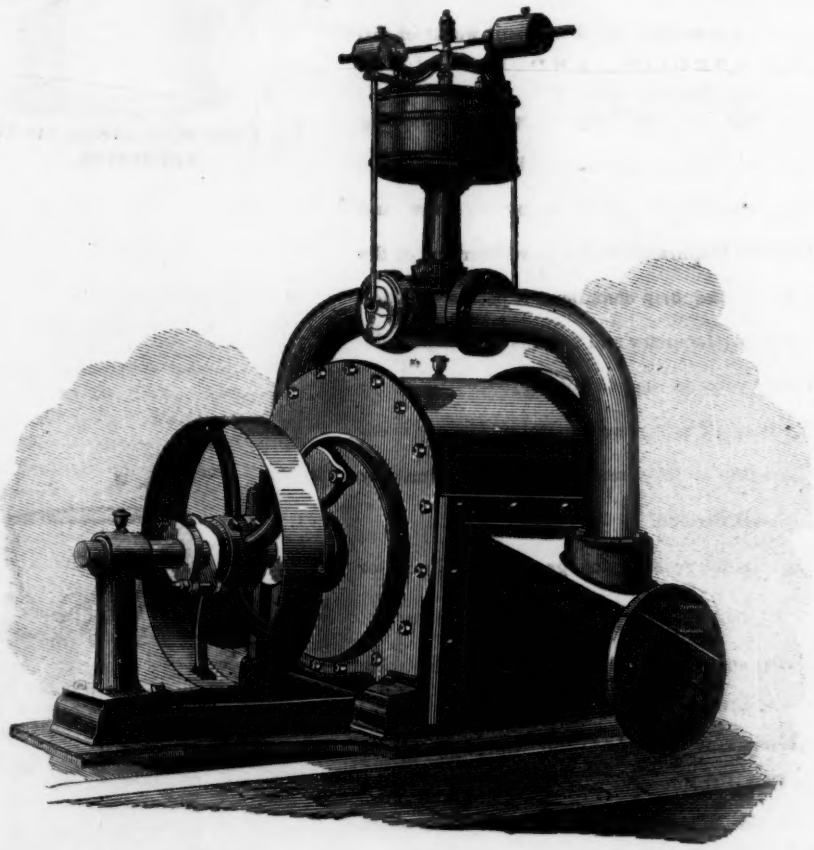

They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating power of the gas, and add very much to the durability of the retorts, either clay or iron. The Compensator obviates entirely the necessity of water-joints, is compact, durable, cleanly, not liable to get out of order, self-acting, quiet, and certain in its operation.

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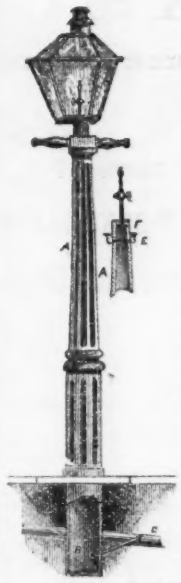

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Yours truly,
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Sec'y Wooster Gas-Light Co.

Address the Patentee,
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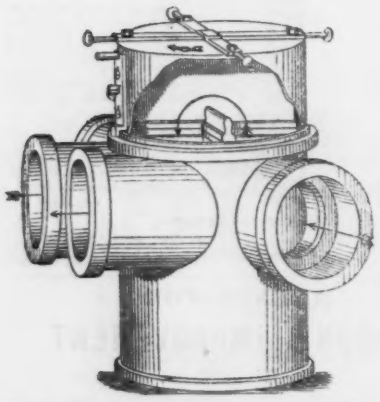

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They are constructed with water seal compartments to pass the gas through the required channels without leakage; with drip chambers to catch the water of condensation, tar, and ammoniacal liquor; and also with a loose or circular valve, to control the direction of the gas flow.

The By-Passes shown in the annexed illustrations, are similar in construction and varied in size to suit works of different capacity

No. 1 is a By-Pass for Gas Works of small generating power, and using but a single apparatus; the gas from the retorts enters the proper nozzle, as shown by the arrow, and being deflected by the diaphragm of the valve over one of the vertical partitions of the drip chambers, it passes through one of the nozzles to the meter and returns to be again deflected by the rotary valve to the gas holder.

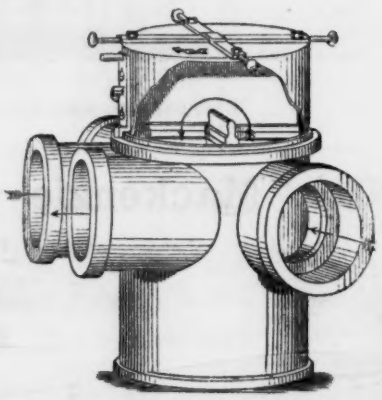
No. 2 is a By-Pass for using two apparatus, the gas is entered and the direction of its current is controlled similarly to that of No. 1, just described.

No. 3 is a By-Pass for passing the gas around the meter or not, according to the set of the loose or circular valve.

No. 4 is a sectional view of No. 3, and fully illustrates the construction and arrangement of the various By-Passes; the vertical partitions P are placed at right angles and divide the By-Pass into four drip chambers, they extend to within a short distance of the bottom to allow the water W, which forms the water seal, to circulate freely; the valve V is constructed with a diaphragm which divides it diametrically, the edges from ground joints with the upper edges of the partitions P, to prevent the gas from leaking from one chamber to another, and also to protect the ground surfaces from the corrosive action of the gas.

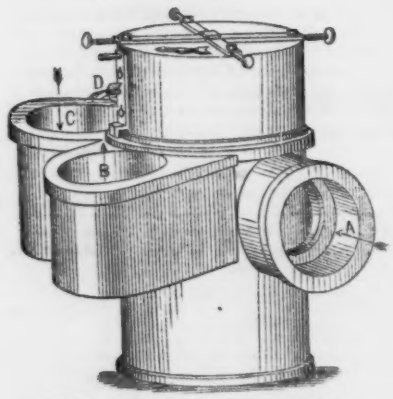
No. 5 is a single By-Pass with Drip Chambers.

No. 2.



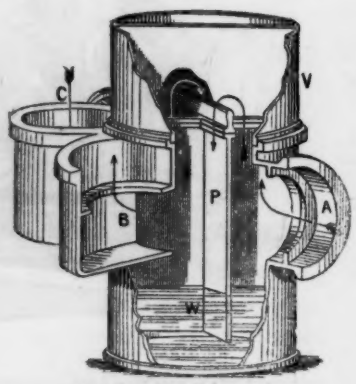
By Pass with Drips for two Apparatus.

No. 3.



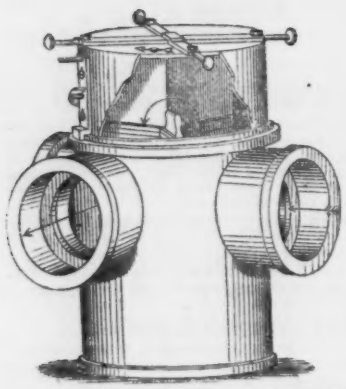
Meter By Pass with Drip.

No. 4.



Section of No. 3.

No. 5.



Single By Pass with Drip.